Paving and Municipal Engineering

VOLUME IV. JANUARY, EIGHTEEN NINETY-THREE. NUMBER I.

MUNICIPAL EQUIPMENT AND ENGINEERING OF PARIS*.

I.

A GREAT city is an organism which is born, grows, improves or declines as it gives attention, or not, to its material, mental and moral welfare. The health, wealth and future of a city depend upon its engineers as much as upon merchants, law makers and teachers. Paris, with its 3,000,000 people living in comfort and cleanliness, demonstrates the great value of a good municipal engineering plant. Paris is one of the best cities, in some respects the best city, in which to study efficient public works.

To better present the subject, it is best to glance at the history of Paris, keeping city improvements in mind rather than its political development. Many of our American cities are impeded in comfort, convenience, health and beauty by too little study and attention to municipal engineering and by too much attention to political power.

A century before Christ, Paris, then known as Lutetia, was a fishing village. A strong palisade is the first record of engineering work. Caesar's troops conquered the Parisii and their allies at Lutetia and made the town an important Gallo-Roman market place. A monument from that period is now to be seen in the Cluny museum of Paris. About 400 A. D. the Emperor Chlore built a palace and large baths, the extensive ruins being still preserved in the Cluny Square. Old records state that "streets were straightened and covered with Roman pavement," large flagstones of irregular shapes fitted together, and "foot paths were provided with hard earth and gravel." A forum, a church and bridges from the island

*Copyrighted.

to both shores were built. Four long roads were finished, one to the English channel, one to Belgium, one to Germany and one to Helvetia or Switzerland. Fragments of the large, smooth, stone pavements of these roads are now put together in the Cluny Museum. Parisii was fortified and withstood the passing tribes of Goths, Burgonds and Germains. Fortunately, Attila, "The Scourge of God," with his Huns, did not besiege Paris.

Finally, the Franks came, captured it and made Paris one of their capitals. With a part of the wealth captured from elsewhere the Franks built at Paris castles, churches, convents, monasteries and in 886 A. D. rebuilt the walls of the city. Then for the first time a Frankish city withstood a Germanic enemy 30,000 strong. By the year 1000 Paris, having become the capital of the whole Frankish monarchy, gave great attention to the erection of religious edifices, castles, towers and walls. It was extended and divided into three parts, the "*Cité*" on the island, the "*Ville*" on the right bank and the "*Quatier Latin*" on the left bank.

Philippe Augusta about 1200 A. D. added eighty new streets and had rough stone pavements laid on certain streets used by the troops. The Roman pavements had almost disappeared. Most streets were narrow, crooked and ill-smelling. A new wall inclosing Paris, covering 622 acres and requiring thirty years' labor, was finished. Then came a standstill. For 200 years only war due to royal strife was known. The seeds of the future power of the Parisians were sown by the formation of brotherhoods of merchants and manufacturers. These unions established a regular but feeble police, which soon became better than those of the king.

In 1356 Prince Charles called the first council together, twelve nobles, twelve church dignitaries and twelve citizens. His motive was selfish. He desired to get help in raising money for himself and his troops. But the germs of popular will were sown the moment citizens were asked to advise in state matters. The public soon declared through Marcel, a merchant leader, that certain public improvements and reforms were needed. The unlimited power of the French kings was openly questioned. The desired improvements began. Higher schools and an art school were undertaken. A collection of 900 volumes was the beginning of the now famous National Library with so many books and manuscripts that years

of labor have not yet catalogued them all. In 1357 a house was purchased and then one built for citizens' meetings. Thus was founded the city hall, which means so much, if in good hands, for the development of a city. Then came the first public theater. Printing came, and the noted National Publishing and Printing Office began its career at about 1470. At this time the population was nearly 125,000. The next important event was in 1529, when the College of France was founded, now so great, with its branches in many cities. The aid to the poor was made a branch of the city business, now so efficient in the bureau of "Assistance Publique." City hospitals were built. Paris was divided for better government into sixteen sections. A law was passed forbidding the houses to project over the streets. Then in 1550 came a special tax and the undertaking of regularly cleaning the streets, a problem not yet solved by most of our cities and hardly undertaken by many.

War came, religious Protestant-Catholic war; worse war can not be conceived. For half a century no peace, no progress. The terrible deed of the Night of Saint Bartholomew, August 24, 1572, caused more than 30,000 deaths and drove from France many of her best builders and artisans. Grass grew over the streets. Thousands of houses were empty; many houses were in ruins.

About the year 1600 came great progress in commerce, manufactures and construction. Carpet weaving and the Gobelin tapestries received an impetus. The handsome bridge Pont-Neuf was completed in 1607. The idea of uniting at Paris the best artisans of all nations crystallized into the "Conservatoire des Arts et Meties," so important to civilization. At this time Paris had for mayor the able man, Miron, who demonstrated the progress a city can make under the right man. He caused to be constructed excellent stone quays, drinking and other fountains and sewers. He widened a few streets and paved many. Paris surpassed other cities of that period, but it was by no means perfected. Most streets were unpaved. Deep mud holes abounded. Police force was weak. Duels constant. Begging and robbery were prosperous. Public parks were reserved almost every day for the nobles. The nobles, shoddy gentility and beggars were one-fifth the population. Religious property covered one-fourth the city. Thus the unproductive classes being so great and not even paying taxes, discontent

among tax-payers began and public works ceased. During the two generations of war following the best that can be said is that there was only one period of five months when no man was whipped or put to death for political reasons.

Toward 1700 Paris became quiet. The police were reorganized. The city was cleared of beggars, sharps, thieves, etc.; even the nobility were made subject to arrest if guilty of misdeeds. Street lanterns with candles, 6,500 in all, were introduced. Public carriages and three omnibus lines were undertaken. There were then more than 500 streets. The population was about 525,000.

In 1718, just after the John Law financial fever, the greatest speculation probably the world has ever seen, came the first organized labor strikes, so detrimental to municipal improvement. Previous to placing the names of the streets, in 1728, on the corners, it was only by tradition that the names were preserved. An attempt to number the houses was only partially successful, because the nobility considered it degrading to have their houses known by a number. Merchants were compelled to remove their signs hung over the streets. Oil began to replace candles for street lighting.

The king shortly after 1774 began to realize that more must be done for the public good. In rapid succession arose the military school, the wheat exchange, the mint, the Pantheon, the "Place de la Concorde" and its bridge. Then came a good fire department, many sewers, much paving, several new bridges bringing the two parts of the city into closer connection. Then the private pawnshops were supplanted by the excellent government pawn establishments, of such value to the poor. Little idea can be formed of the immense advantage resulting from the foundation of the great civil engineering school, "Ecole des Ponts et Chaussées," whose graduates have steadily improved, beautified and paved the streets of Paris until they have become the models for the world, besides constructing smooth macadam roadways to all parts of France. These same engineers built the mighty sewers and great water-works of the French capital, besides directing the public works in all its branches. Trained men, above political influence, holding positions for life or during good conduct, carefully tabulate and map every detail of plan and cost of public work, thus enabling their successors to take up the improvements and carry them to even greater suc-

cess. Engineering statistics and their reduction to units of measurement and cost is a subject sadly neglected in too many of our cities. At the same period were established the schools of mines, medicines, music, oratory, blind, etc. The building of the Chamber of Deputies and several new theaters were erected.

Then came the precursor of the improvement which has been made in so many European cities; the city walls were torn down and used to fill up the moats and trenches outside of them. The space thus gained was converted into broad, handsome boulevards and parkways. About seventy new streets were added to the city. The bridges were cleared of old houses and shops upon them. Whole cemeteries were transferred from about the churches to places far without the city. An immense real estate and building "boom" added several splendid sections to the city. This caused the city engineering bureau to make a profound study of the problems of street network and its relations to the lay of the land, convenience, health, beauty, etc., of the city. The general plan and changes determined upon in 1783 have remained the basis of arrangement and equipment of the streets, avenues, boulevards and parks of modern Paris. The city contained at this time 650,000 people.

Civilization owes much to France, not only for what she produced before the terrible blood-bath of her revolution, but also to her for many results obtained by that revolution. Among other benefits due to the introduction of reforms is that of the metric system of weights and measures now used by all scientists in all lands. After the year 1800 Paris, although provided with beautiful buildings, bridges, etc., suffered because of its poor pavements and lack of sewers. Gutters were generally in the middle of the streets. Oil was still used in street lights. About 1837 gas was introduced. Then a water supply was established for the whole city, better pavements introduced. However, it was not till after 1853 that Paris began a thorough reconstruction of her streets. Hundreds of houses were taken down to make room for new streets and for widening others. Noiseless asphalt pavements were introduced. A grand system of sewers was projected and executed. The municipal engineering department, sustained by an ample supply of funds, has made Paris a handsome, clean and healthful city, the center of attraction for travelers from the entire world.

J. W. Howard.

ONE of the American engineers who realizes the importance of careful study of city thoroughfares, is Maj. J. W. Howard, of Newark, N. J. He has given careful attention to municipal engineering and for several years has given most of his time to the equipment of streets both above and below ground. In 1881–4 he visited the European cities of importance, even those of Spain, Egypt and Turkey. In the latter, however, there is little to copy, but much to show the importance of good city engineering.

Firmly convinced that vast improvements are needed in the cities of the United States, and that paving is a branch of city engineering the least developed in our cities, he decided to make a specialty of municipal engineering. He visited the principal cities of the United States in 1887 to observe street pavements. He tersely reviews the state of affairs which PAVING AND MUNICIPAL ENGINEERING is endeavoring to improve, when a guest of the Scranton Board of Trade. In an address, afterward published by the board, he said:

"Paving has been regarded by some as not a branch of engineering. So were water-works, so were sewers, so were other branches of public work until, after costly experience, our cities entrusted these things to men who were both practical, scientific and economical.

"The study of the health and progress of a city means to discover how much depends upon street pavements. It means to learn how to make life more agreeable and business more profitable; how to increase the earning power of a city; how to reduce the tax on business caused by poor pavements; how to reduce the number and cost of horses to move our loads; to reduce the cost of repairs to pavements, vehicles and harness; the cost of street cleaning and of excessive sprinkling; also to remove the cost and injury to health and houses, goods and furniture due to poor and dirty street pavements."

Maj. Howard made another visit to Europe in 1886 and additional tours to examine streets in 1888 and in 1892, the last one being made to observe especially the asphalt pavements.

Maj. Howard, in his articles and addresses published in PAVING AND MUNICIPAL ENGINEEING and other publications, shows the importance of increased study of city pavements.

James Waite Howard, the subject of our sketch, is one of a line of industrious Americans originating in England and established at Bridgewater, Mass., about 270 years ago. His forefathers were Puritans. The branch from which he comes has lived for three generations in Maine. His father is Gen. O. O. Howard, United States Army, who, as well as his mother, is from Maine. He is one of five sons and was born at West Point, N. Y., shortly before the civil war, when his father, then a lieutenant, was stationed there as instructor in mathematics. He received his early education in private schools and then entered a high school. By the changes of residence usual to an army officer, his father took the son with him from place to place. Thus the son developed an inclination and ability to compare cities unbiased by local influences and prejudices. Having finished at the high school, he went to Alaska in 1876 and then to Andover, Mass., and graduated at Phillips Academy in the classical course. He followed this up by practical work in railroad construction and tunneling on the West Shore Railroad. Being on the West Point section he again lived with his father, now a veteran officer and in charge of the military academy. His son benefited by his residence at West Point by attending lectures and taking such lessons, being a guest, as seemed of advantage. He then went to France and finished a course of study there. Then, after visiting several German universities, he decided upon a course of higher mathematics and physics at the University of Göttingen, Germany. After his return to the United States and some experience in Nebraska at practical work, he decided that a course of study and a degree of civil engineer from an American institution would put him more in touch with American methods of construction. Because of previous education he was able to shorten the course

of study at the Renssalaer Polytechnic Institute at Troy, N. Y., at which place he graduated with the desired degree.

During his life Maj. Howard has given much time to National Guard matters, and has risen to his present rank by serving in the National Guard of several states. His present commission is in New Jersey, where he resides.

As is usual with men who have had his advantages and improved by them, Maj. Howard is a member of several social and scientific societies. He has a fund of knowledge and many acquaintances in cities at home and abroad. He has gathered many books and pamphlets in English, German, French and Italian bearing upon city engineering, and especially upon street construction and equipment.

PAVING BRICK; DIFFERENCES OF QUALITY.

You ask me to make suggestions that may enable the inexperienced buyers to determine when they are getting good material and how to get it.

The art of making brick in the United States suitable for paving streets is as yet comparatively young, and even those who have been longest engaged in it hesitate to express decided views as to the best manner of manufacturing and burning, or even just what test should be applied to ascertain the grade of paving brick best adapted for street use. My actual experience in this business dates back to less than three years ago, although I confess to several years of investigation prior to that. Readers will therefore bear in mind that I shall endeavor not to be dogmatic, and that in all essentials I am a learner, not a teacher. I shall simply try to give the results of my observations, and admit that my opinions formed upon these results are liable to be changed by further experience.

I have been greatly surprised in reading the numerous letters I have received from persons seeking information on this subject to find so much ignorance of the quality of material necessary to make a good paving brick. While thus far a large percentage of the brick made for street use have been made of what geologists term shale, yet by no means all of them have, or at least very fine brick have been made of material that differs greatly in appearance and analysis from any shale I have ever seen.

In Illinois wherever coal is found shale exists, and so far as my experience goes it is very much alike, but the so-called shale found in Kentucky and Ohio is very different from it. At Cloverport, Ky., where brick are made that are admirably adapted to paving purposes, the material in the bank is largely granulated rather than

stratified, and the same is true of much of the material I have seen in Ohio.

At Galesburg we have made up many samples of clay and shale from different parts of the country into brick. One of the most satisfactory of these was a clay from Menominee, Wis. I do not know the analysis of it, but for all practical requirements it was fully the equal of any shale I have ever seen.

This brings me to make my first assertion, viz.: That any material that can be reduced to the consistency of meal, mixed thoroughly with water, made into brick, dried without cracking, and when set in a down-draft kiln thirty to thirty-five high can be burned to a thorough vitrification and retain their shape, will make a good paving brick. The point on which most manufacturers and users of paving brick differ is to decide just what thorough vitrification means.

At our works in Galesburg I could show you six brick, all different, but any one of which seen by itself would be pronounced by experts as a No. 1 paver. Show the whole six at one time and ask the experts which was the best and the fun would begin.

City engineers, city inspectors, manufacturers and contractors are human and their opinions as to the quality of a brick are formed by looking at it, feeling it and perhaps breaking it open, and usually there are as many verdicts as jurors. If these differences are sufficiently wide to necessitate other tests, the chances are that the crushing strength of the brick would be ascertained and some of them put into a machine to test their wearing ability. Neither of these tests is satisfactory or has thus far proven what the qualifications are for the most durable paving brick.

My own opinion is that a brick will stand the wear of street use best when burned just to the point of vitrification, *i. e.*, just before it reaches the brittle point. I also think it will stand a better test for strength and wearing off by attrition when possessed of the toughness which disappears when the brittle point is reached. Thus far we have failed to find out how to get a whole kiln burned just to this point and no farther. If we knew that our theories were absolutely correct there is no question in my mind but that a kiln of brick could be burned with at least 90 per cent. of this kind, but when one city engineer insists on having brick all black burned, as

hard as glass, while another insists that he wants none of that kind, as they are too brittle, the poor brickmaker is in despair.

What we want, and what ere long we shall certainly have, is a common sense standard, which shall be a guide. I say ere long; I mean by this when actual wearing tests have been made on streets already paved.

You will see by the above how difficult it is to instruct the inexperienced buyer how to get the best paving brick. Who shall give the instructions? There are certain requisites that common sense and experience will indicate as necessary, but the dividing line between just right and a little less or a little more, is as yet too fine to describe by *D. V. Purington.*

D. V. PURINGTON, the foremost brick manufacturer in the United States, has had a variety of experience, with some adversities, but a greater share of success. He was born in Sidney, Kennebec county, Me., January 22, 1841. He grew up as a farmer boy, attended the common schools and, to use his own words, "kept out of the reform school until he was nineteen years old." Then he taught school until August, 1861, when he entered a New Jersey regiment as a private. He distinguished himself as a soldier, serving until the close of the war, and was discharged from the army in January, 1866, as a captain. He afterwards spent two years in the Freedmen's Bureau in Virginia. In April, 1869, he located in Chicago and embarked in the lumber business, in which he encountered some adversities, and in January, 1872, he entered the employ of Strauss, Hahn & Co. as timekeeper and general utility man in one of their brick yards. He was not long in regaining his foothold and turned to good account the thorough knowledge of the brick business acquired in his experience. He is to-day one of the leading business men of Chicago. He will this year make 90,000,000 common brick in Chicago and 30,000,000 paving brick at Galesburg, Ill., where he has one of the best equipped plants in the country. His plans now contemplate the enlargement of his plants so as to enable him to turn out next year 550,000 common brick daily in Chicago and 300,000 paving brick daily in Galesburg. Physically, he is well equipped for his large responsibilities. He says he "does not remember the time when a physician looked at his tongue or felt his pulse."

FRENCH AND AMERICAN ASPHALT PAVEMENTS COMPARED.

Some time ago the United States government instructed its consul in Paris to look up the question of asphalt pavements, it being generally understood that the French had some peculiar methods of their own leading to the excellence of their work. Soon after I learned of the purpose of the government I began a series of in-

vestigations, the results of which have been laid before the readers of PAVING AND MUNICIPAL ENGINEERING. All details of the question of the use of asphalt have been studied and the methods specifically analyzed and published. I now feel that I am in a position to make certain general statements in regard to the question of asphalt both in France and America.

It is proper to say in the first place, that the Americans do not spare any labor, as far as I have been able to observe, in putting down asphalt covering. They certainly use more labor in producing the same result than is common in France. The great difference is in the material. The asphalt which I have seen applied in America is in no way like that used on the streets of France. Here it is a dry, hot, chocolate colored powder. It is not in any sense mastic; it possesses no liquid qualities. It is a thoroughly dry powder. When thrown from a wagon onto a wheelbarrow it dusts over the side. It is distinctly granular and entirely dry. In appearance it is almost exactly the same as powdered cocoa. It is brought to the street where it is to be applied in iron-bodied wagons and spread while yet hot and then pugged by hand into a solid mass.

The asphalt, so-called, which I have seen applied in America, has almost universally possessed certain mastic qualities and has been very dark in color. It has had a sticky quality and been always soft, though slightly granular. It has been not dry, not powdery and altogether has had an entirely different appearance from the asphalts of this section.

The manufacture of asphalt has been described, and no more need be said in that connection at this time. However, it may be well to say, in general terms, that the asphalt of France is a distinctly natural product; that it is pulverized asphalt rock as it is taken from the mines, which has been changed only by being reduced to a powdered state when it is used. They heat it and pound it back into its original state. There is no sand, gravel or other foreign material used in the composition. A little gravel is sometimes sprinkled on the top, though this is not necessary or usual. The process of street making is very simple. After the foundation has been prepared the asphalt in its powdered state is heated and deposited in its proper place, raked out to the proper depth and pugged by hand with heavy iron rammers. The puggers are fol-

lowed up by men who iron the asphalt with the usual hot irons. Frequently this is all the labor there is attached to putting down the pavement. It is only occasionally that light rollers are used.

It is interesting to notice that the French do not depend on the skill of the rakers and spreaders to preserve a uniform surface. They rake the asphalt as carefully as possible and then run a straight-edge over it in a way to remove all of the superfluous material and bring about a perfectly even surface. Guides for the straight edge to run on are laid in at frequent intervals, say sixteen to eighteen feet apart, and by spreading a little thick and then drawing the straight-edge over the powder an exact and perfectly uniform surface is secured. It depends upon no one's skill in raking to bring about uniformity. This is positively secured by the use of the straight edge.

Something may be said about the mixing of cement. I have noticed at home that cement is frequently mixed on a bed and the ingredients thrown in according to the judgment of some one in charge. In Paris this is altogether a matter of measurement and formula. The judgment of the workmen is not exercised in this matter. It is simply a question of measurement for every part of the mixture. They use in mixing the cement a board floor and bottomless box about forty inches square and twenty inches high. Into this box is first placed some coarse, screened, wet gravel, it having been washed on its way to the mixing bed. This washing is done by placing the screened gravel in wheelbarrows with grated bottoms, through which water can pass when it is turned on at a hydrant. As stated before, this wet gravel is thrown into the box as it rests on the floor, so that it occupies about one-fourth of the inside. On this is spread a small portion of sand and on the top of the sand one-half of the cement, which goes into the mixture. In quantity there is something less than a half a bushel. On top of this cement is another portion of sand, again other gravel, another portion of cement and a covering to the top of sand. After it has been leveled the wood case or bottomless box is lifted off and men with shovels turn the mixture over so as to thoroughly incorporate the different parts. It is then shoveled to the edge of the platform and sprinkled with water at the same time that it is mixed until it reaches the proper consistency. This water is measured out into

large sprinkling cans so that the exact quantity is used. Thus there is a uniformity of gravel, sand, cement, water and labor. The formula of handling the mixture with shovels is quite as uniform as the proportions of the mixture. Thus it is clear that nothing is left to judgment. The cement is examined, the character of the gravel and sand known and the mixture prescribed. Then the different proportions are maintained without the slightest variation either in sand, gravel, cement, water or labor; all are exactly uniform. The workmen do not in the least have to exercise their judgment.

The grade of the cement bed is maintained in the same way as that of the asphalt. Grade stakes are set at frequent intervals, and from one to the other are fixed rests or guides of wood for a straight-edge. Having filled the space between with a little more concrete than is necessary, the straight-edge is raked over it several times, until all is perfectly smooth and uniform. Thus, when the cement hardens the entire surface is quite as smooth as the most exact floor. There is not the slightest depression or irregularity.

Asphalt covering is largely used for the floors of market-houses, courts, public yards and many other locations of similar character. However, this is quite a different material from the asphalt of streets. This is the same as is used for sidewalks, which is asphalt *coulé*, or mastic asphalt. This material has some of the same general characteristics of the asphalt composition used for paving in America. However, it contains a larger proportion of the bitumen of asphalt, and is softer than the American street composition, this quality being to a larger proportion of asphalt in bituminous form and a correspondingly smaller proportion of sand and foreign material. While the asphalt of the streets is a natural material, asphalt *coulé* is a fabrication; is a manufactured product.

The asphalt covering which is used for the floors of market-houses and other structures is admirably adapted to cleanliness and sanitation. It is a non-absorbent material, is capable of being worked in such a way that only slight grades or slants of surface are necessary in order to have it drain perfectly. The principal thing necessary to make a successful pavement of this kind is that the concrete foundation, which is usually from four to five inches thick, be rendered quite as smooth as is the final covering.

It can be closely and accurately joined to iron or stone gutters in a way to place no obstruction in the way of perfect cleanliness and good drainage. *Louis H. Gibson.*

LOUIS H. GIBSON is an architect of Indianapolis. His studies of a practical character were conducted in the architects' offices of Indianapolis. His academic education embraced a two years' course in the architectural department, Massachusetts Institute of Technology, in Boston, and fifteen months of technical study and travel in Europe. Mr. Gibson regards his interest in municipal work in its relation to comfortable living, and for that reason not indirectly associated with his work as an architect; the work of the architect being a part of that which has to do with comfortable living, and in its association with good streets, good roads, proper sanitation and other matters affecting the home and the home comforts of the people. During the summer of 1891, Mr. Gibson occupied a part of his time in walking over the roads of France, studying their construction, and gathering literature bearing upon the French system of road construction, taxation, and general organization. The result of his work along this line will be given in future numbers of PAVING AND MUNICIPAL ENGINEERING.

OLD TOWNS AND NEW STREETS.

A GOOD street is a smooth floor suited for noiseless and comfortable travel, and easy to keep clean. The causes of damage are horse-shoes, wheel-tires and water. The greatest of these is water. There is no hope for any kind of a street-floor if it is not well drained, and it is folly to spend any money whatever on a street not properly graded to dispose of surface water. Therefore, before a penny is spent on a street-floor, or even before we determine what the floor is to be made of, we must determine the grades. The whole city system must be provided for in the grade system. It is not enough to provide for carrying the water off of one street and dumping it onto another street. All the water must be carried from all the streets and discharged away from the entire system. All cities have, or should have, a low point in the neighborhood to which all street drainage can flow. Sewers are another matter entirely and have nothing whatever to do with the question of streets. Sewers are house drains exclusively and must not be open to the streets.

Each street has to handle the water which falls on it, and also such water as flows to it on its way to the river from other streets.

A street gutter is therefore at once a drain for its own street and an intermediate canal leading from outlying districts to the river. This being the case it will be at once seen that the duty of a street-gutter and hence the proper grade for that gutter can never be determined by its own street alone. We may even ignore its own street, for if the gutter is properly graded to do its work as an intermediate canal, between other gutters and the river, its own street will not impose serious additional burdens upon it. If, by short-sightedness, we have graded a gutter for a certain duty without proper thought for future town-growth, we will soon find that added outlying gutters are pouring their waters into a set of intermediate gutters never calculated to deal with these waters. This means overflow, and discomfort to travelers, and it means death and destruction to the streets. The remedy is to replan the entire grade system. No good can be done at any one spot or on any one street, or any number of streets less than the whole, and more than that, the lesson of the past must bear fruit in provision for the future. New grades are to be gotten by a little filling and much cutting. Property owners can recover damages if change in established grade does any damage, providing the property is improved property; unimproved property can not recover damages; grade-raising may make damages; grade-lowering can seldom make damages. Hence, grades are to be changed by raising where there will be little or no damage and by lowering at other points, and by short underground drain-connections in rare cases.

The process of arranging for the new grades is as follows: The engineer makes a grade map of present levels, including all outlying areas likely in the future to pass their surface water through the city gutters. He then calculates the quantities of water to pass to the river and makes the most expedient distribution of the flow among the various streets in the system, having in view the present levels and the cost of changes, maintaining old grades where possible without sacrifice. The new levels give him a new grade map which shows the direction and grade of fall throughout the entire system. From this map a description of the grade of each street is written up. This description is passed as an ordinance,

which ordinance is to expressly repeal all existing grade ordinances. Thereupon the new grades become legally established.

Then comes the work of bringing the streets to the new grade. It is a cutting process mainly, and may be done slowly, and must begin at the river sides or low points of the finished system. There is no grand upturning and inconvenience, and not necessarily any great expense at once.

When this work is done the streets will, in many cases, be good and satisfactory, the main cause of evil having been removed. But it will very likely be judged expedient, while this regrading is under way, to put upon certain of the streets a better floor-surface than they had before. Then comes the study and the choice between stone, wood, macadam, asphalt, brick, and gravel. But the time for this study and choice has not come yet and will not come till the new grades are established and the work mainly done, and the question of paving will be found of interest only in connection with two or three streets. Nothing could be worse than to pave improperly graded streets, and when the grades are right, a hard surface does not become so important on streets which are otherwise well built, well drained, and well cared for.

The brief of the story is: The streets were good; the grades were bad; the prosperous town has outgrown the flow-capacity of the grades; the streets are therefore going to the dogs; nothing can save them without new grades; with new grades and proper maintenance, the system will be generally satisfactory; a few streets will demand a hard floor-surface, at joint expense of abutters and the general community; the work will then be done; from time to time other citizens will recognize the direct profit of the thing and make similar demands; and eventually the city will find all the street-floors paved. *J. W. See.*

James W. See is an engineer of Hamilton, Ohio. He is one of those who believe that a municipality finds its possessions to consist merely of a piece of engineering constructed at great cost, added to at great cost, and mantained at great cost; and that the too common tendency is to ignore the fact that maintenance should always take the form of betterment in order that an antique structure may conform to modern needs; that money expended in repairing in old lines is often money thrown away; that the greatest burden in municipal taxation lies in this expenditure; and that the burden becomes not only bearable but pleasant, when the expenditures are in the form of betterment which satisfies pride and improves the value of the property burdened by the tax.

MAINTENANCE OF ROADS IN FRANCE.

Maintenance does not mean repair. When a road has been neglected and becomes cut up by ruts, full of holes and bumps, it needs repair. This may be the subject of another article, but here I mean simply maintenance.

Where a road is in a good condition, the surface well drained and perfectly smooth, without ruts or depressions, without dust or mud, when the ditches are clean, that state of thing can always be maintained if the proper care is taken and the proper method is followed; and it is cheaper to maintain a good road at any cost than to let it go to wreck and then repair it.

In a good method of maintenance of a macadamized road there are but two things to attend to:

First. The continued removal of the worn-out material, either in the shape of dust or mud.

Second. The judicious use of material to replace the wearing out.

Those two operations well made and made in proper time will prevent the tearing up of a road and cause the travel to wear its surface uniformly.

Dust is the stone pulverized; it makes the roads pull hard; it is a nuisance to the neighbors, and is a danger for the road; in fact, when it rains it becomes mud, keeps the macadam moist and soft, which, consequently, is easier cut up by the wheels. When a road is clean of dust, rain-fall drains off fast and the road soon becomes dry and solid, but the mud not only keeps the road wet and soft, but also causes the formation of ruts, and ruts must be avoided at any cost.

For instance, a wagon travels a road covered with mud. It does not attack the macadam, but it leaves a track that will naturally and easily be followed by the next wagon, and by the next, and so on, and if the first wagon did not damage the road the following ones will. If the rainy season lasts long enough the road will then be out of repair, as it is next to impossible to fill a rut without inviting the formation of another one alongside of the first one.

For all well organized systems of roads it will prove to be an economy to carefully remove the dust and the mud.

In old times I have seen the section men, "cantonniers," rake

and sweep the dust as well as the mud and it was then considered a paying work. What will it be now that we have street cleaners that can do ten times the same work ten times more economically?

Of course when we come to the practical application of this theory there will be a variety of ways of doing it, according to the climates and the materials we will have to deal with, but the fact will remain the same and it will be seen that if the dust and mud are removed the road can be maintained perfectly uniform and smooth; still it will wear out until it may be entirely removed in the form of dust and mud. To prevent this we have, annually, to replace a quantity of crushed stones equal to the amount of dust and mud removed. *Arthur Lagron.*

ARTHUR LAGRON was born in 1836 in the department of Saône-et-Loire, France. His father being himself an engineer on the public roads, had the son especially educated for that position. He was as early as 1855 in charge of maintenance and construction of roads in the Départmente of La Loire. Then he served a term of five years in the French Army as an officer in a regiment of engineers and fought at the battles of Magenta and Solferino, Italy, in 1859. After that he worked alternately on public roads and railroads in France until he determined to see some new country and came to America. He bought a farm in the south part of Montgomery county, Mo., eighteen miles from the nearest railroad station, where he had all the opportunity a man wishes to make a thorough study of what a farmer loses for the lack of good roads. For the last ten years he has been surveying and building railroads in half a dozen states, but mostly in Missouri and around Kansas City. He has also been city engineer of Chillicothe, Mo., assistant city engineer of Rockford, Ill., where he made a record as a sanitary engineer, and now is in Freeport, Ill., where he is putting in a system of twenty-two miles of sewers.

SPECIFICATIONS FOR BRICK PAVEMENTS.

THE Detroit Board of Public Works has adopted the following specifications for brick pavements in that city:

Old Pavement.—The old pavement to be taken up, and all material and rubbish, including whatever surface dirt may be on the street at the time, shall be removed from the street and disposed of by the contractor, except that the city will reserve such of the best of the material as the board of public works may select and remove from the street after having been taken up by the contractor.

Grading.—The street to be graded to its established grade, under the direction of the board of public works, and to be excavated to

such a depth below the true grade as the board may deem necessary for the purpose of receiving ballast for the roadway. The bottom of excavation when completed shall conform to the section or crown of the street as furnished by the city engineer. If there are places in the street which are not firm or properly settled, caused by trenching or connections of sewers, gas or water pipes, the earth must be taken out and the space refilled with broken stone or coarse gravel and pounded to make it solid. In all cases where filling may be necessary to bring the bed to the required height, it shall be done in layers not to exceed six inches in depth, and be thoroughly tamped or rolled to insure a solid bed. None of the earth excavated shall be piled upon the sides of the streets, unless required for filling a low spot at the point where left.

If the contractor shall excavate deeper than the depths shown on the diagram, the depressions shall be filled with broken stone or gravel.

Before placing the ballast or concrete thereon the sub-grade in each block shall be well rolled with a steam roller weighing not less than seven tons; if the contractor does not himself own such a roller, the same to be furnished and operated by the city of Detroit at a cost to the contractor of one cent per square yard. The surplus earth, if any, must be disposed of by the contractor, the said board reserving the right to direct the contractor to remove any earth it may require for the purpose of filling up any low lots, alleys and sidewalks to the proper grade within the assessment district, or for six hundred feet outside thereof.

Tile Drain.—The contractor will excavate a trench twelve inches wide on each side of and beyond the line of the roadway to the depth of twenty-four inches below the established grade. The bottom of the trench to be smoothly trimmed parallel to the curb grade, and have laid thereon a continuous line of well-burned four-inch tile, to be well connected to the receiving basins. Joints are to be well covered with tar paper and the tile covered with broken stone or gravel.

Foundation.—When the roadbed has been prepared as specified above, it will be covered by a layer of concrete six inches in thickness, and prepared in the following manner: The component parts of the concrete will be: One part of freshly burned and finely ground

American cement standing the following tests made by the city engineer: No more than ten per cent. will fail to pass through a sieve of twenty-five hundred meshes to the square inch; when mixed neat with the least amount of water necessary to make a good mortar, it will sustain a tensile strain of not less than sixty pounds per square inch, after being allowed to set in air for one hour, and followed by an immersion in water for twenty-four hours; two parts of clean, sharp lake or river sand, free from clay, loam or vegetable matter; five parts of crushed or broken boulders, granite, syenite paving brick, hard limestone or clean screened bank gravel, the pieces not to be larger than two inches or smaller than one-half inch in any dimension. The sand and cement shall be thoroughly mixed while dry, and then just enough water will be added during the mixing process to make a good mortar. The crushed or broken stone must be screened if necessary to free it from dust, dirt or stone refuse. After being wet with clean water the crushed or broken stone shall be thoroughly mixed on boards with the cement mortar until every piece of stone is completely enveloped by the mortar. The proportions will be fixed by actual measurement. This concrete will be immediately applied to the roadbed, and rammed until the surplus cement mortar appears upon the surface, which latter will be made parallel to the roadbed and in exact accordance with the diagram. No walking or driving will be allowed on the concrete until it is thoroughly set. All defects in this foundation, no matter from what cause, must be repaired or corrected before the work will be allowed to progress.

Cushion.—A cushion coat of clean, sharp sand, well screened and free from all other substances, will be spread over the concrete foundation to the uniform depth of one inch, when well compacted.

Curbing.—Curbing now set upon the streets to be taken up, rejointed and reset to the proper line and grade wherever directed. New curbing to be set wherever ordered, and must be of the best quality of Medina, Hammond, Berlin Hights or Berea stone, and to be of the following dimensions: Medina, four inches thick and not less than three feet long; Hammond, four inches thick and not less than four feet long; Berlin Hights, four inches thick and not less than four feet long; Berea, four inches thick and not less than four feet long; all to be eighteen inches deep; stones to be flat tool

or crandle dressed, true and smooth; with close joints at the end, at least fifteen inches below the top of the curb, and shall have a straight and even face on the side towards the gutters to the same depth as end joints; top to be dressed to a straight line, and to a one-fourth-inch bevel in five inches, and to a uniform thickness of four inches, and brought to a straight line on top and face by use of a straight-edge. Stones to be taken out of wind, and to be cut with a three-fourths-inch flat tool-draught on upper edge of face, stones to be set with close joints to the true line and grade of the street, and settled into place with a paver's rammer, and the sand, in front and rear, tamped with a heavy hand-tamper to the full depth of the stones. Curbing to be jointed and set as directed around curves and corners at same price as for straight work. All junctions at street corners will be set as a true segment of a circle of four feet radius, in one piece, except Medina stone, which may be in two equal segments. The curb to be set in a bed of properly compacted sharp, clean river or bank sand, and backed up with the same material to the full depth of the curb and width of excavations, and well tamped down. Back-filling to be done by the contractor a distance of three feet from the curb, where the top of the same is above the natural surface, and all to be left in a neat and sightly condition.

Paving Brick.—Shall consist of the best quality of sound, hard-burned paving brick, made and burned specially for street paving purposes, and shall stand all reasonable tests as to durability and fitness, to which paving material is usually subjected. All bricks to be square-edged and straight, free from cracks and other defects and of uniform size, and of a quality to be approved by the board of public works, and equal to the approved samples in its office.

Kind of Brick Bid Upon.—Each bidder shall state in his bid the kind of brick that his proposition is based upon, which must be of such kind as has been approved by the board of public works, and the brick to be used upon the street under such contract shall be equal in every respect to the approved sample in the office of the board. Each kind of brick bid upon shall be a separate bid.

Statement.—Each bidder shall also, if required, furnish a state-

ment showing the proportion and kinds of material used in making the brick and the manner of making and burning the same.

Inspection of Brick.—All bricks to be open to thorough inspection by the board of public works and its agents, both before and after laying, and all rejected material shall be immediately removed from the street and the deficiency made good by the contractor, and he shall at all times provide, at his own expense, a sufficient number of men to assist the board of public works and its inspectors in the proper inspection and culling of the bricks.

Manner of Laying.—Upon the cushion, when prepared as heretofore specified, the paving bricks are to be laid in the following manner: The pavement is to be constructed with a single layer of brick laid on edge, end to end, in right angle courses across the street, as the board of public works shall direct, except at street intersections, where the courses are to be placed at such angles as the board shall designate. The bricks are to be set in straight courses across the street, with the body of the bricks close together, sides and ends touching, and breaking joints at least two inches with the bricks in the adjoining courses; they are to be set perpendicular with the grade of the street and to a height of from one-quarter to three-quarters of one inch, or to such other height as the board of public works may direct, above the true grade and crown of the street when finished, to provide for settlement in pounding and rolling. Nothing but whole bricks shall be used, except in starting a course or in making a closure at curbs, catch basins and street structures, when not less than half bricks may be used in breaking joints, which shall be made tight and close at ends. Great care shall be taken in breaking and trimming the bricks for this purpose, so as not to check or fracture the part to be used; all joints to be broken or cut at right angles to top and sides of the bricks. The breaking and trimming must be done by experienced men working with proper tools.

Defective Bricks.—All soft, cracked or defective bricks found in the pavement any time before its final acceptance shall be removed by the contractor and the place made good at his expense.

Rolling and Tamping.—The paving, when laid as specified, and either before or after the filling of the joints and top dressing is put on, as the board of public works may direct, shall be thoroughly

rolled three or more times lengthwise of the street with a steam roller weighing not less than seven tons. All parts of the pavement which can not, in the opinion of the board of public works, be properly rolled shall be thoroughly rammed not less than three times, in such a manner as the board of public works shall direct.

Cement Filling.—The joints will, as far as possible, be completely filled to the bottom with a cement composition of not less than ten per cent. of refined Trinidad Asphalt, mixed with coal tar cement distilled at a temperature of not less than 600 degrees, Fah., and the whole mixed with such proportion of still-wax as not to soften or become brittle under heat or cold.

Top Dressing.—The composition shall be heated and used at a temperature of not less than 300 degrees, Fah., to be determined by a proper gauge or indicator placed upon the tank used in the street; extra material and care shall be used at the gutters in filling all joints in both paving, curbing and around catch basins or other receptacles, to effectually prevent the leakage of water into the sub-roadway; all joints to be completely filled to the top, and refilled such number of times thereafter as may be directed before adding top dressing. The cement not to be used until the brick are completely dry. The surface of the paving, when completed as above, shall be covered with a half-inch top dressing of clean, coarse sand or gravel, of approved quality, which, with all accumulations, shall afterward be removed from the pavement by, or at the expense of the contractor, at such time as the board may designate before the final acceptance of the work by the board of public works, and the pavement left clean for inspection.

The price bid for the paving to include all labor and material, ballasting, filling, top dressing and tamping necessary in the preparation of the sub-grade, and in the treatment of the paving when laid, including the composition to be used in filling the spaces between the blocks.

Marginal Finish.—There shall be set at the edge of the brick pavement where it crosses any intersecting street or alley a line of retaining stone of the same quality as the curbstone. These stones shall be four inches thick, not less than eighteen inches deep, and

not less than three feet long, and conform to the surface of the pavement with their exposed edge.

Orders to be Obeyed.—Whenever the contractor is not present on the work, orders will be given to the superintendents or overseers who may have immediate charge thereof, and shall by them be received and strictly obeyed. And if any person employed on the work shall refuse or neglect to obey the directions of the board of public works, or its duly authorized agents, in anything relating to the work, or shall appear to the said board to be incompetent, disorderly or unfaithful, he shall, upon the order of the board of public works, be at once discharged and not again employed on any part of the work.

Defects Before Acceptance.—All settlement, defects or damages in any portion of the pavement, by public travel, rain, snow, ice, frost, or other causes, before the final acceptance of the work by the city, shall be repaired and made good at the contractor's expense. All rubbish which may accumulate during and by reason of the work herein provided for, shall be removed by the contractor as fast as the pavement is laid, and the street left clean and in good condition.

Material on Street.—Material delivered on the street, either before or after dressing, to be neatly and compactly corded up along the sides of roadway, in such manner as to cause the least inconvenience to property owners and to the general public. Private drives and street crossings to be kept open. Shade trees, sidewalks and other improvements shall be protected by the contractor from all damage by stone or otherwise.

Obstructing Travel.—Travel upon the street, or upon any intersecting street or alley, shall not be hindered or inconvenienced needlessly, nor shall any portion of the roadway or street be opened up, nor shall the same be wholly obstructed without the direction of the board of public works, in which latter case the contractor shall cause plain and properly worded signs, "Streets Closed," announcing such fact, to be placed, with proper barricades, at the nearest cross street, upon each side of such obstructed portion, and upon intersecting streets, where travel can pass around the same in the shortest and easiest way.

Colored Lights.—Colored lights, and, if required, night watchmen

are to be maintained, at the expense of the contractor, when necessary, to prevent accident.

City Rights Reserved.—The city reserves the right to lay or relay any or all necessary gas, water or sewer pipes during the progress of the work, or to build or rebuild any catch-basins, sewers, cisterns or street railroad tracks.

Guarantee.—The contractor will furnish a five year guarantee for his work, without extra charge. The guarantee to be of such form and nature as the board of public works may direct.

If at any time during the continuance of said guarantee the pavement should be opened for the purpose of putting in the street sewers, gas pipe or water mains, or repairing the same, or for any other purpose, the contractor shall relay said pavement at a cost of ten per centum above the original price, and when said pavement is relaid and restored, said guarantee shall extend to the pavement so relaid and restored for the balance of the time for which said guarantee is to continue, and in no case where it shall become necessary to disturb said pavement for any of the purposes above mentioned shall it be deemed as releasing said contractor from said guarantee.

Inspection.—The work shall at all times be subject to inspection by the city as the work progresses, but such inspection shall not relieve the contractor from any obligation to perform said work strictly in accordance with these specifications, and work not so constructed shall be removed and made good by the contractor, whenever so ordered, without reference to any previous oversight in inspection.

Assignment of Contract.—The first party shall not assign or transfer this contract or sublet any of the work embraced in it, without the consent in writing of the board of public works being first obtained.

Work and Forfeits.—The work embraced in this contract shall be begun within one week after written notice so to do shall have been given to the contractor by the board of public works, and carried on regularly and interruptedly thereafter (unless the said board shall otherwise, in writing, specially direct) with such a force as to insure its full completion within.....thereafter; the time of beginning, rate of progress and time of completion being essential conditions of this contract. And if the contractor shall fail to

complete the work by the time above specified, the sum of twenty-five dollars per day for each and every day thereafter, until such completion, shall be paid to the city of Detroit through the board of public works before acceptance of the work.

Protection for Labor and Material Supplied.—The contractor, for himself or for any sub-contractor under him, shall well and truly pay, as the same may become due and payable, all indebtedness which may become due to any person, firm or corporation on account of any labor or material furnished in connection with the contract of which these specifications form a part; and in case of his failure so to do, and on written notice of any unpaid claim for labor or material as above being filed with the board of public works, a sum of money sufficient to cover such claim or claims shall be retained from any moneys due or to become due said contractor on his contract, and if such claim or claims be fully substantiated to the satisfaction of the board of public works, said board shall pay such claim or claims from the moneys so retained, any residue to be paid such contractor on the completion of the work.

Proposals.—The city reserves the right to accept or reject any or all proposals made under these specifications at any time within thirty days after the same are received.

PLANTING TREES IN THE STREETS.

THE question of trees in the streets is, or at least ought to be, of interest to every town-dweller, for it is only in trees and grass plats and occasional climbing vines that he is able to get a glimpse of the country, which seems to many to be man's natural birthright. It is a good sign that there is a growing taste for the cultivation of the beautiful Japanese ivy, which will grow so luxuriantly on the front of a brick or brownstone house, and requires the smallest possible amount of attention. Give it a rooting place in good, rich soil, and nature does the rest. In two years or less your house will be half covered with the rapidly growing climber, and in a little longer time it will be completely embowered in it. The

cost is only a trifle, and this ivy, or ampelopsis, is absolutely free from objectionable features.

In the scanty soil which trees are likely to get in paved streets, they necessarily have a hard time. Nevertheless with a little care they may be made to thrive and do well. Lowell has said:

> Who does his duty is a question
> Too complex to be solved,
> But he, I venture the suggestion,
> Does part of his that plants a tree.

How many city dwellers have performed this part of their duty? Not so many as the lover of trees would be glad to see do it.

On the general subject of street tree-planting, Colonel John Y. Culyer, the well known landscape architect of Brooklyn, talked in an interesting way the other day. "I notice," said he, to a New York *Tribune* reporter, "a spasmodic revival of interest in street trees during the lax summer season, if indications in the papers are correct. I have on several occasions called attention to the matter. In my opinion the failure of large numbers of street trees to thrive is to be attributed primarily to lack of intelligent interest in street tree-planting, and, in the second place, to general neglect. Trees planted in our city streets even under the most favorable conditions must of necessity be compelled to grow amid many disadvantages. The principal causes of failure, so far as they may be understood by non-professionals, may be briefly enumerated as follows: First, the selection of the tree; second, planting, and third, maintenance.

"For street planting only a few varieties of trees are at all available. Of these the family of maples supplies the best resource, since maples will grow under discouraging circumstances and are especially suitable for our purpose, being clean, long-lived, and tractable; moreover, they will respond to the smallest help, being, as it were, solicitous to please and to show an appreciation of human attention. No one who understands trees will be surprised that I speak in this way about the maple. Of the various kinds, the silver or white-leaved maple grows the most rapidly, and is perhaps the least desirable; but nevertheless it is far superior to some kinds of trees used for street planting. The sugar maple, the Norway maple, the sycamore maple, the scarlet maple, and even

the finer varieties, such as the cut leaf, etc., will all do well, and if nourished and properly cared for are less likely to be infested by insects than almost any other kind of a tree. The aimable elm needs moisture, but will flourish in clay, or in a rich, loose soil. Then there are the English and American lindens, which require a certain pruning in growth to adapt them to street purposes; the Carolina poplar and the ailantus, the latter of which grows rapidly, but is not specially desirable.

"There is a craze for planting large trees—say from four to six inches in diameter—both in streets and upon lawns. In eight cases out of ten, to be conservative, under the ordinary conditions of removal, they fail. The safe rule is to go to a reputable nurseryman, select under his guidance a well-formed, perfect tree two or three inches in diameter, with a full natural head and fibrous roots, pay him his price for it, and then plant it properly. The chances are that in these circumstances success will follow. It is a crime to cut off the top or natural head or leaders of a young tree, since its chances of attaining perfection and permanency are thereby impaired, if not destroyed. After selecting a tree such as I have described, dig a pit at least four feet square and as many feet deep, fill it with good loam or soil, plant the tree in this, placing it as to depth just to the point where the trunk leaves the main roots. This is the natural and proper depth. Spread the roots out lightly and evenly, fill in the soil carefully, and finally cover the whole compactly; and behold, the tree is planted.

"Next as to maintenance. In the first place, leave a space at least equal to three feet in diameter uncovered by flagging and open to the sunlight, the winds and the rains. Apply each season, in the fall and spring, a little surface stimulation, such as would be afforded by well-rotted manure or some artificial fertilizer. In the spring pick up the soil loosely around the tree and mound it up lightly, so that too much moisture shall not penetrate to the roots. Be sure to protect the bark from injury; and I am tempted to advise the tree-owner to shoot any horse that nibbles the tree, or to use drastic measures in dealing with its owner. Keep up this course of treatment, and the chances are that the response of Nature will be entirely satisfactory. What is worth doing at all is

worth doing well, and the rule is particularly applicable to the subject in hand.

"Now, what is the matter with many of our older trees? Well, the general answer may be given in one word—neglect. They are being supported on poor-house fare. They have outgrown their supply of nourishment and likewise their environment; they are craving food. In short, they are starving. Take up the flagstones that confine and coffin them; dig up the earth around them; fertilize them, and many of them may yet be restored and enjoy a vigorous life. Others, too long neglected, will gradually die. Many trees also want prudent pruning, thinning out of dead and surplus wood. For my part I would be glad to give advice gratis in order to save a good street tree. New streets in our cities ought to be planted properly in the beginning, and thus in time they will become pleasantly shaded thoroughfares."

UNDERGROUND WIRING FOR ELECTRIC RAILWAYS.

In a discussion on underground wiring for electric railways, at the Cleveland meeting of the American Street Railway Association, Mr. Pearson, of Boston, said, that while the ordinary method of returning the current through the rails and supplementary wire would be sufficient in small towns or where there are few cars running, on large roads where the traffic is heavy, more return grounds than have been used heretofore will have to be installed. It was found in Boston that from a lack of return feeders there was a great deal of electrolytic action on the supplementary wires, and as a remedy a large amount of overhead copper is being put up for returns. It was not thought advisable to put it underground on account of the rapid corrosion, and there is no advantage in using iron on account of the low conductivity. In regard to using the trolley wire as a positive or a negative, he originally ran the positive current through the trolley wire, but found that the action on the supplementary wire was too great, and changed it and put the negative to the trolley wire. This merely transferred the action to another point.

In answer to a question regarding trouble with water pipes, Mr. Pearson said that he did not remember any particular trouble with

water pipes, but if there is a large current passing through the earth it will take hold of any convenient pipe, and there will be electrolytic action. In any large railroad system, if the attempt is made to use the earth for return ground by putting in ground plates in driven wells, or elsewhere, and a good metallic circuit is not provided for the return current, the current must inevitably injure the water pipes and all other pipes. The current when it leaves the cars goes into the ground, and taking a water pipe may go a mile on that pipe and then leave it for a better conductor; the result being that the pipe will be corroded at this latter point.

Mr. Richardson, of Brooklyn, asked in regard to using old rails as returns by putting them in the ground, using five or six or more, side by side and so making a continuous path for the return circuit, proper fastenings being provided.

Mr. Pearson thought it would be difficult to make a good joint, and that without it there would be heating and corrosion, and that a copper joint would not do as there would be electrolytic action under any circumstances. It was attempted in the early days of electric railroads to use the rail for the return conductor without putting in supplementary wires, and found almost impossible to maintain a joint of any sort. When a large current is passed through a joint oxidation takes place, and the joint soon becomes worthless. This condition will exist no matter how large the joint is made, and if dissimilar metals are used a local electrolytic action will also take place.

In answer to another question Mr. Pearson said that they had used a considerable quantity of old steel and iron cable, in getting across rivers and connecting supplementary wires, but that it cut away very rapidly. For instance, in one place seven cables were put in with thoroughly soldered joints, and in less than four months they were entirely gone.

Mr. F. S. Holmes said that he had the opinion of an engineer experienced in street railroad work, to the effect that when there was a sufficient number of ground plates along the line the current was about equally divided between the rail return and the ground wire. The construction we have to-day, where ground plates are used for return currents, makes the trolley wire and the various plates and supplementary wire along the line of the road positive

and the large ground plate at the station negative. This is wrong, because the supplementary wire and ground plates along the line are rapidly corroded, while the negative plate at the station is uninjured. The conditions should be reversed, the station plate being made positive and the line plates and supplementary wire and trolley negative to it. Corrosion will then be largely confined to the station plate, which can be easily replaced. To accomplish this the current must, of course, flow out by the ground, which will be positive, and back by the trolley wire, which will be negative.

THE NEW JERSEY ROAD LAW.

THE laws of New Jersey are now well calculated to encourage the building of good roads in that state. The policy as embodied in recent enactments on this subject is the most liberal and progressive in the Union. The law passed by the last legislature perfected and enlarged the systems attempted to be carried out in the act of 1891, but which became inoperative by reason of the failure of the legislature to provide for the appointment of a state commissioner of agriculture. By the act of last winter the duties devolved upon the latter named official are placed upon the president of the state board of agriculture.

The law as it now stands provides that whenever a petition signed by the owners of two-thirds of the lands bordering on any public road or section thereof, not less than one mile in length, shall be presented, praying the board to cause such road to be improved under the provisions of the act, it shall be the duty of the board to cause such improvements to be made.

The estimated cost, however, of all improvements made in any county in any one year shall not exceed one-half of one per cent. of the ratables of the county for the preceding year.

One-third of the cost of all roads constructed under this act shall be paid for out of the state treasury, providing that the amount so paid will not exceed $75,000 in any one year. The $75,000 set apart for this purpose shall be apportioned by the governor and the president of the state board of agriculture among the counties of the state

applying therefor, in fair pro rata proportion to the cost of the roads constructed in each.

Two-thirds of the cost of the roads thus constructed is to be borne by the county, and the county board of assessors are required to include the sum in the county taxes assessed for such year, and the same shall be assessed, collected and paid over to the county in the same manner and within the same time that other county taxes are paid.

The adjoining property owners may be assessed for benefits to an amount not exceeding ten per cent. of the entire cost of the improvement.

Any road thus constructed shall forever be a county road, and the duty of keeping it in repair shall forever devolve upon the county.

The provisions of the New Jersey laws, it will thus be seen, place the main burden of constructing the improved road upon the state and the county, relieving the adjoining property owners of all but the possible assessments of only ten per cent. of the entire cost.

Movements are in progress in different parts of the state to fulfill the conditions upon which the state appropriation of $75,000 may be secured.

CURRENT INFORMATION.

COST OF WATER-WORKS IN SMALL CITIES.

Many water-works plants are being established in cities of from 5,000 to 10,000 population, and there is a general demand for information as to the probable cost of such plants. The best information on the subject can be gathered from the following statistics:

Alliance, Ohio, population, 6,130; private company; source, Mahoming river; pumping capacity, 3,000,000 gallons; mains, six miles; cost, $145,000; hydrant rental, $60.

Ashtabula, O., population 10,000; private company; source, wells near Lake Erie, two miles distant; pumping capacity, 3,000,000 gallons; mains, 14 miles; cost, $320,000; hydrant rental, $45.

Bellefontaine, O., population, 5,000; municipal source, flowing wells; pumping capacity, 1,500,000 gallons; cost $100,000, 6 per cent.; total annual revenue, $2,000, making an annual loss or cost for hydrants, $5,800, allowing $1,800 for operating expenses.

Bucyrus, O., population 7,000, private company: pump capacity, 2,000,000 gallons; mains, 12 miles, wooden pipes; cost, $108,000; hydrant rentals, $55.71 for first 70, $40 for each additional.

Crestline, O., population, 3,000; municipal, source, springs, gravity; mains, nine miles; cost, $100,000; annual net revenue, $1,200.

Defiance, O., population, $8,500; private company; source, Maumee river; mains, 13 miles; cost, $175,000; hydrant rental, $40.

Delaware, O., population, 9,000; private company; source, wells and springs; main, 18 miles; cost, $200,000; hydrant rental (206 hydrants), $38.

East Liverpool, O., population, 7,500; municipal, source, Ohio river; pump capacity, 1,500,000 gallons; mains, 16 miles; cost, $151,000; operating expenses, $5,000.

Sault St. Marie, Mich., municipal, population, 8,500; source, river; pump capacity, 1,500,000; mains, six miles, small pipe; cost, $50,000, 6 per cent.; operating expenses, $4,500; interest, $3,000; total, $7,500; receipts, $2,500. The city pays itself, therefore, for hydrant rental $5,000 annually for 50 hydrants without making any provisions for a sinking fund.

West Bay City, population, 10,000; municipal sources, river; pump capacity, 3,000,000; main, 13 miles; wooden pipe; cost, $75,000; revenue from consumers, $2,500; annual operating expenses, $6,000. Its 111 hydrants therefore cost the city $8,000 annually, or nearly twice as much as the water supply company propose to charge for the same number of hydrants and better pressure.

Ypsilanti, population, 7,000; municipal sources, wells in drift gravel; pump capacity, $2,000,000; mains, 17 miles; mostly small; cost, $140,000.

Monroe, Mich., population, 6,500; private company; source, Lake Erie, mile and a half; pump capacity, 3,000,000; mains 15 miles; cost, $150,000; hydrant rental, $46.90.

Warsaw, Ind., population, 4,000; private company; source, lake; pump capacity, 2,000,000 gallons; mains, five and a half miles; cost, $95,000; hydrant rental, $50.

Wabash, Ind., population, 9,000, private company; pump capacity, 2,000,000 gallons; mains, 12 miles; cost, $175,000; hydrant rental, $45.

Valparaiso, Ind., population, 6,500; private company; pump capacity, 1,500,000; mains, 12½ miles; wooden pipe; cost, $100,000; hydrant rental, $80 and $50.

Mt. Vernon, Ind., population, 5,000; private company; source, Ohio river; pump capacity, 2,000,000 gallons; mains, nine miles; cost, $100,000; hydrant rental, $46.66.

The logical deduction from the foregoing is that water-works systems generally cost in cities of from 5,000 to 10,000 inhabitants more rather than less than $100,000, even

where the source of supply is close to or within the city; also that tax-payers generally have to pay as much for fire protection in interest and operating expenses above revenue as they would have to pay a private company for the same service in the shape of hydrant rental. In the cases cited the municipal water-works have no private companies to compete with them.

POLLUTION OF STREAMS BY SEWAGE.

A remonstrance having been filed by a number of citizens of Indianapolis against the emptying of sewage into Fall creek, a stream passing through a part of the city, though the public water supply is not taken from it, the question as to pollution of the water was submitted by City Civil Engineer Mansfield to Prof. C. T. Chandler, professor of chemistry of Columbia college, one of the best and most eminent authorities on water analysis in the United States, who made the following reply:

"In reply to your favor I would say that I should not hesitate for a moment to allow these 150 houses to be connected with the drain which has to discharge into the stream that runs through the city. I do not think the amount of sewage which they would deliver would have any appreciable effect on the character of the water in that stream, considering the fact that the water is not to be used for drinking purposes.

"I will inform you further, that the city of Albany has now been drinking the water of the Hudson river for twenty years without filtration, and that it is one of the healthiest cities in the United States and has been so during this entire period of twenty years, notwithstanding the fact that the city of Troy, eight miles above, drains into the river, with a population of about 60,000, and that several other towns drain into the river above Albany."

To what extent a stream may receive sewage without becoming a nuisance, though unfit as a source of water supply, may be seen by the following:

"In pollution of water of the Blackstone river, in Massachusetts, which receives the sewage of Worcester (report of Massachusetts board of health), the following estimates of the sewage entering the stream are given:

Sewage of Worcester (minimum amount)	2,000,000 gal.
Sewage of mill operators	36,000 gal.
Fluid refuse of mills (estimated)	2,500,000 gal.
Total	4,536,000 gal.

"The dry weather flow of Blackstone, including sewage, is taken at 5,961,000 cubic feet per day. In this case we have 5,365,092 of unpolluted water, mixed with 606,508 cubic feet of badly polluted water, or 10 per cent. of the water in the stream is sewage. This stream, in 1875, was not considered a nuisance."

Comparing this percentage with that which would be found in Fall creek after 170 houses connect with it, *i. e.*, one part in 18,000, or .006 of 1 per cent., we see how little effect the small amount of water would have on the stream.

"Sewage diluted with twenty times its volume of water and running a distance of ten to twelve miles, will be destroyed." Other authorities state that it will be destroyed in three miles.

RAPID TRANSIT IN NEW YORK.

The result of two years' research and deliberation on the part of the New York Rapid Transit Railroad Commission has been given to the public in a report, advocating an underground railroad traversing New York in the lines of greatest travel, with ramifications and side tracks to less traveled portions of the metropolis. The plans call for a four-track electric railway, with a total length of fifteen miles, the main line of which is to run from the Battery through Broadway and the Boulevard to Fort George, and thence northward to Yonkers. The road will be 44 feet wide and 11½ feet high. Both local passenger and express trains will be run on scheduled time at a 5-cent passenger rate. There are contemplated 35 stations for passengers, and 10 express depots. There will be two loops, one from Broadway at Bowling Green to South Ferry, and back through Whitehall street to Broadway, and the other from Broadway around City Hall Park to the bridge entrance. The underground portion extends only to Forty-third street. From thence viaducts,

half-sunk tunnels and bridges will be used. All the stations below Manhattan street will be underground.

The specifications state that the load to be supported by the underground construction shall be estimated as 1st, weight of soil and pavement, 2d, weight of pipes and other structures beneath the pavement, 3d, weight of roof, 4th, live load on the street, total to be assumed at not less than 1,500 pounds per square foot of surface.

Electricity must be used, and the motors shall be sufficiently powerful to readily start a train of eight cars weighing, loaded, not less than 30,000 pounds on a gradient of 1½ feet in 100 feet of distance. The motors must maintain a speed of not less than 40 miles an hour. Should each car carry its own motor the above requirements must be in proportion. The rails are to be 75 pounds to the yard, and block signals are to be used.

The franchise is to run 999 years, and the company must have a capital stock of $50,000,000 in $500,000 shares. The company must protect the city in $2,000,000 bonds, finish the road, pay 10 per cent. of the receipts, and pay out anywhere from $75,000,000 to $100,000,000 for the road.

The commissioners who have completed this task are: President, William Steinway; vice-president, J. H. Starin; J. H. Inman, Samuel Spencer, and secretary E. L. Bushe. The engineers most prominent are John Bogart and William Barclay Parsons.

ANNUAL MEETING OF BRICK MANUFACTURERS.

Indications are in every way favorable for a successful meeting of the brick manufacturers at Louisville, beginning Tuesday, January 24. The Louisville brickmakers have made very complete arrangements for the entertainment of the visiting members of the national association, including probably a banquet, a drive around the city and a trip to the Mammoth Cave or the vitrified-brick plant at Cloverport, Ky. Committees were appointed as follows: Arrangements—A. L. McDonald, Phil Donahue and F. E. Hebden, of New Albany. Finance—F. W. Manly, Harry Demusnil and Albert T. Bemis.

Among the papers to be presented to the Association during its sessions are the following:

"Burned Clay," L. J. Howard, St. Louis, Mo.; "The Professional Brickmaker," Jos. Fairhall, Grape Creek, Ill.; "The Mistakes of Brickmakers," general discussion, led by a member of the Western Pennsylvania Brick Exchange, Pittsburgh, Pa.; "Association Among Brickmakers," Alexander Prussing, Chicago; "Manufacture of Brick from Shale by the Dry Press Process," by J. R. Figh, Dallas, Texas; "The Evolution of the Brick Machine," Cyrus Chambers, Philadelphia; "Old Fogy Brickmaking," E. O. Glidden, Boston; "How Best to Dry Brick," general discussion, led by D. G. Rhoads, Omaha; "Enameling Brick," Isaac Hardy, Aberdare, Eng.; "Paving Brick—Their Manufacture and Use," W. S. Williams, Canton, Ohio; "Burned Clay as a Roofing Material," John R. Elder, Indianapolis; "Front Brick—Their Relation to Architectural Design," James Taylor, New York, N. Y.; "The Fuel Question," general discussion; "Vitrifaction of Clays," A. L. McDonald, Louisville.

METHOD OF MAKING HARD BRICK.

In the western parts of Mongolia there are such rapid alterations of temperature that ordinary bricks and even the usual building stones disintegrate very rapidly. The inhabitants of that country have a process for making extremely hard bricks, sonorous, and having the appearance of trachyte. The article by Mr. E. Blanc in *Dingler's Polytechnisches Journal* describing the process does not inform us as to the exact constitution of the clay. The brick kiln is in the shape of a vertical cylinder, surmounted by a dome. There is a rather wide hole in the top of the dome, and during the first part of the process the hole is left open. Three draught chimneys built inside the furnace open outwards at the height of the dome and are kept closed with clay at the beginning of the operation. The kiln is heated for three days during the first part of the process, and then the hole at the center of the dome is gradually reduced in size by means of blocks of moistened clay. The flame is allowed to die down and the small hole re-

maining is covered with wet felt. The felt is covered with sand, which is continually kept moist. The three lateral chimneys are then opened and the fire lighted again. The draught is thus reversed and the second stage of the process thus commenced lasts for four days. During this time the water from the felt is heated and fills the kiln with an atmosphere of superheated steam. At the beginning of the second part of the process the bricks have light red color and this changes to uniform dark gray. At the end of four days the bricks are completed.

WOOL USED FOR A BRIDGE FOUNDATION.

When the National pike bridge, west of Richmond, Ind., was in process of construction, the workmen at the west side of Whitewater river dug down to find a solid foundation. They struck a great and seemingly bottomless bed of quicksand. Vainly they labored to find a safe resting place for the foundation. Finally the civil engineer and the contractor struck on a novel expedient to overcome the difficulty. They sent men all through the country to buy wool. They purchased nearly all of that commodity in adjacent counties, and the primitive woolen mills were compelled to pay high prices in order to procure anything to work on. This wool, unwashed, burrs and all, was delivered on wagons of all sorts. It came piled high, on beds constructed for the purpose, and all was tumbled into the hole intended for the foundation. As pressure was applied it sank some distance into the sand, but finally it would sink no further. At last, on this woolly foundation, the rocks were laid, and to-day the western abutment of the old national bridge rests on a bed of compressed wool.

INDIANA ENGINEERING SOCIETY'S ANNUAL MEETING.

The thirteenth annual meeting of the Indiana Engineering Society will be held in South Bend, January 24-26. Mr. Everett B. Vawter, of Lafayette, the corresponding secretary, in a letter to PAVING AND MUNICIPAL ENGINEERING, says that the programme is not yet complete. "You may announce, however," he says, "that we have promise of the best meeting in the history of our organization, and papers will be read by men prominent in the various departments of the engineering profession, as well as those identified with the principal educational institutions of the state. Among the names that will appear on the programme we might mention: Prof. A. E. Phillips, Purdue University; Prof. M. A. Howe, Rose Polytechnic; Prof. M. J. McCue, Notre Dame University; Jno. W. Fawcett, C. E., Delphi; Calvin Carter, C. E., Brookville; A. W. Smith, C. E., Kokomo; Thos. Finley, Shelbyville; J. F. O'Brien, surveyor Putnam county; M. A. Ruder, C. E., Monticello; Wm. M. Whitten, city engineer South Bend; J. F. Merghan, assistant city engineer South Bend; E. M. Culp, city engineer Anderson; R. I. Morrison, C. E., Knightstown; L. S. Aller, C. E., South Bend; Jno. W. O'Bannon, city engineer Elwood; Jno. E. Alter, county surveyor, Rensselaer; Wm. P. Carmichael, C. E., Williamsport; F. Hodgman, Climax, Mich. The subjects to be treated are: Street pavements, sewer construction, drainage, bridge work, public roads, legislating, etc."

STREET INDICATOR FOR ELECTRIC CARS.

A street indicator for electric cars has been tried recently by the Albany Railway Company, of Albany, N. Y. A similar method of announcing the names of cross streets, used for a time on the South Chicago cable roads, was worked by the gripman, and it was found to be more than the gripman could attend to. The Albany indicator is placed inside the car over the door, and consists of a series of narrow signs so arranged that only one is visible at a time. The indicator is operated automatically by a current from the trolley wire. A finger projects down from the trolley support wire near each street corner in such a way as to strike a trigger on the trolley arm of the car. The effect of this is to turn the indicator one notch, so as to display the name of the street which the car is approaching and to ring a bell to attract the attention of the passengers. As these fingers are at some distance from the street corners, passengers are warned in time to notify the conductor where they

want to stop. It is said to be a decided improvement on the oral method of announcing the names of streets, as there is no danger of misunderstanding the name, and it eliminates the frequent opening of the car door in cold weather. As soon as the car reaches the end of the line the reversing of the trolley changes the mechanism of the indicator, and the signs are reeled off in reverse order.

ILLINOIS BRICK AND TILE MAKERS.

The programme for the Illinois Brick and Tile Association, which convenes at Springfield, January 17 and 18, includes the following:

Annual address by the president, C. F. Tenney, Bement, Ill.; a paper on "Hard Roads," by Joseph Stafford, Springfield, Ill.; "What has been Learned in Twelve Months about Brick or Tilemaking," by volunteers; "Report of the World's Fair Committee," paper read before the Illinois Commission; "Terra Cotta," a paper by William Gates, Terra Cotta, Ill.; Banquet at night at the Palace Hotel; Clayworking from Different Standpoints: "As a Tilemaker," by E. M. Pike, Chenoa, Ill.; "As a Brickmaker," by Anthony Ittner, St. Louis, Mo.; "As a Clay Journalist," by J. J. W. Billingsley, Indianapolis, Ind.; "Prices and Profits," a paper by George Gillen, Cantrall, Ill.; "Practical Road Drainage, by J. J. W. Billingsley; a paper, "The Manufacture of Brick and Tile," by Thos. E. Bonfield, St. Anne, Ill.; "A Poem," by D. O. Loy, Ashkum, Ill.

AN ELECTRIC EXCAVATOR.

There is in use at the works of the Purington-Kimball Paving Brick Company, near Chicago, an electric excavator. It is used for excavating clay in the clay pits, for which a steam shovel was used until recently. Electricity was substituted for steam by disconnecting the steam-engine and substituting for it a 50-H. P. Thomson-Houston motor, which is supplied with current from a generating station several hundred feet away. Feeding wires are run from the generating station to the edge of the bank, where they are connected to a pair of trolley wires arranged so that they can be moved from time to time as the shovel advances. The motor is suspended under the car on rubber cushions and is geared to a countershaft, which is in turn geared to the hoisting drum by a friction clutch. The countershaft is also conn cted with the mechanism for operating the boom.

LEGAL DECISIONS.

Dedication and Subsequent Diversion of Street for Railway Purposes.—In an action by a city to restrain a company from laying a railway track in a street, the trial court found that the original owner, in laying out the street on a "map, selling lots, and allowing the same to be used, expressed an equivocal and qualified intent to permit such user as a public highway, subject to the right of revocation;" and that, in permitting defendant to lay certain tracks and to build a freight house in the street, such owner had expressed an intent to revoke such qualified dedication before it was accepted by plaintiff, or by user by the public. At the request of plaintiff, the court found "that there has been a continuous user of the part of the public of the" street "since in or before the year 1845, except as the same was temporarily deflected by the laying of said railway tracks and the erection of said freight house; that from 1845 down to the time of the commencement of the action (1885), the public user of the street has been general, continuous and exclusive for all the purposes of a public street. . . . and that before the construction of the railway track, and the dedication of the street to the public had been accepted by the public by user." At the request of the defendant, the court found "that there never has been any dedication of the street for highway purposes" and "that there never has existed a public highway" at the place alleged by plaintiff. Under the circumstances the city was entitled to the finding most favorable to it; and as there was dedication of the land as a street by the original owner, and an acceptance by the public, it was entitled to the relief sought, against the railway company, which was a subsequent grantee. City of Cohoes *v.* Delaware & H. Canal Company, Ct. of Appeals of N. Y., 31 N. E. Rep. 887.

Macadamizing as Paving.—"Macadamiz-

ing," as shown by the employment of the word in the Pennsylvania statutes of 1887 and 1889, where it is used with "paving" connected by "and" or "or," to designate the general character of street improvements, is a species of paving, within the rule that, where streets have been once paved, they can not be repaved at the expense of abutting owners. City of Harrisburg *v.* Segelbaum, Supr. Ct. of Penn., 24 At. Rep. 1,070.

Excavating Beyond City Limits.—The acts of the city authorities in cutting or causing to be cut a deep ditch or excavation near, in, and upon the side of a lot outside the limits of the city, thereby causing a person's land and fence to fall and cave into said ditch or excavation, to his damage, are *ultra vires*, they having, at the time the acts were done, no power or jurisdiction over the land in question. Consequently the municipal corporation is not liable for damages resulting from such acts. Lord *v.* Mayor, Supr. Ct. of Georgia, 15 S. E. Rep. 818.

Duty of Borough in Laying Water Pipe.—It is the duty of a borough in laying a water pipe along a traveled highway to construct it in a safe manner, and to exercise due diligence to keep it in such a condition as not to endanger the safety of people lawfully passing. Baker *v.* Borough of North East, Supr. Ct. of Penna., 24 At. Rep. 1,079.

Legal Limitations to Rivalry in Business.—While fair and open competition is entirely proper and of public benefit, it is not permitted to a tradesman or manufacturer to appropriate the labels, brands and names adopted by his rivals, nor to announce to the trade his ability and readiness to supply the latter's customers with the very article, under the same name and label, for which the energy and means of the owner of the trade-mark have made a market. Neither is it permitted that he should so closely simulate the brands and labels of his neighbor that the public should be misled into purchasing his goods in the belief that they are the product or manufacture of those who introduced and gave them reputation. And it is not an equitable defense to an action to restrain the infringement of a trade-mark, that the goods or wares of the person accused of infringing the trade-mark are equal in quality to those of the owner of the trade-mark. In fact, a more permanent injury is inflicted upon the tradesman whose goods are supplanted in the esteem of his customers by those of equal quality, offered under his trade-mark, and at lower prices, since the competition of an inferior article is likely to be ephemeral. Cleveland Stone Co. *v.* Wallace, U. S. Circuit Court, Michigan, 52 Fed. Rep. 431.

No Rights are Waived by Paying Freight Overcharges Without Protest.—The payment to a railroad company of an overcharge in freight on goods transported over the road of such company is not a voluntary payment, as the law interprets that term, so as to bring it within the operation of the familiar rule which forbids recovery on account of payments voluntarily made without objection or protest. The law does not here require objection or protest to the payment of unjust charges, for the reason that they would be vain, being addressed to those who occupy the commanding position of power to enforce obedience to their requirements, and because those who do business with railroads never come in contact with the officers who possess authority to fix or abate rates or charges; indeed, they usually hardly know their names or where to find them. Louisville, E. V. St. L. Consolidated R. Co. *v.* Wilson, Supreme Court of Indiana, 3 N. E. Rep. 311.

Liability for Defect in Machinery Unlikely to Do Injury.—There is no negligence in the construction of machinery which, when properly used in the ordinary manner, is safe under all conditions which will probably arise in any and every instance of such use. Hence, although it may have a defect, yet, if that defect be one which does not interfere with its safe and proper use, with reference to the purpose for which it was constructed, an injury to an employe while accidentally in contact with the defective part of the machinery, but which was very unlikely to occur, can not be attributed to negligence on the part of the company owning and operating the machinery so as to render it liable for the injury. Richmond & D. R. Co. *v.* Dickey, Supreme Court of Georgia, 16 S. E. Rep. 212.

Mortgaging Machinery or Goods After Making One Payment on Them.—Where the

purchaser of machinery or goods, after paying the first installment on delivery according to contract, which contract was only a mere order for goods, accepted without reservation of title, executes a mortgage thereon for a new consideration or an old debt, which mortgage is duly filed, the title passes on delivery, and the mortgagee's title is good as against the seller, and this would not be changed, even though after executing such mortgage the purchaser gave the seller, as security for the rest of the price, his promissory notes, each with an express condition that title should not pass until payment in full had been made. Van Winkle *v.* Crowell, U. S. Supreme Court, 13 Sup. Ct. Rep. 18.

Cities Can not Destroy Wooden Buildings Without Process of Law.—It is not a part of the functions of a city government to enforce the terms of an agreement by forcible measures without process of law. So where a wooden building is maintained in defiance of a city ordinance and in derogation of the terms of the permit granted by the city for its erection, the city government has no power to enforce the terms of the permit by destroying the building without process of law, and a restraining order will be granted the owner until the final hearing and determination of the cause. Northern Pac. R. Co. *v.* City of Spokane. U. S. Circuit Court, Washington, 52 Fed. Rep. 428.

Countermand of Orders is no Excuse for not Paying Commissions.—Where a person agrees to pay a specified percentage on such orders as another shall procure, payable when such orders shall be obtained, the latter is entitled to such agreed compensation, even though some of such orders may afterwards be countermanded by the persons giving them. If, however, the orders are countermanded by reason of any default of the person taking them, that can be shown to defeat his recovery. Dorgan *v.* Turner, Supreme Court of Minnesota, 53 N. W. Rep. 650.

Relative Rights of Foreigners and Citizens to Use Trade-Marks.—A foreigner engaged in manufacturing and selling anything in his own country, under a registered trademark, has no common law right to such trade-mark in the United States, such as will enable him to claim the same on establishing a branch business here, as against a domestic firm which had an established business under a similar trademark, adopted in good faith, before he had sold any goods in this country. Richter *v.* Anchor Remedy Co., U. S. Circuit Court, 52 Fed. Rep. 456.

Sale of Goods by Sample.—A sale of goods by sample only binds the vendor to supply goods equal to sample, and not goods fit for a particular purpose. And where the purchaser is sued for the price of goods sold by sample, and alleges failure of consideration, in that the goods supplied are inferior to the sample, he is entitled to relief only to the extent of such failure and the amount of inferior goods which he proves. Kauffman Milling Co. *v.* Stuckey, Supreme Court of South Carolina, 16 S. E. Rep. 193.

Shipping Ahead of Time Does Not Pass Title.—Upon an order for a specified quantity of goods to be shipped to the purchaser on a specified day, the separation of the quantity from the seller's general stock, and shipping it before the specified day, is not an appropriation of the quantity separated to the contract, so that the title passes. It is a condition of the seller's authority to make the appropriation that he shall ship as directed. Hoover *v.* Maher, Supreme Court of Minnesota, 53 N. W. Rep. 646.

Papers Executed in Duplicate Are to be Treated as One.—Where two papers are executed in duplicate, one of the parties signing one of the papers and the other party signing the other, both papers together are to be treated as one document. Richmond & D. R. Co. *v.* Shoma, Supreme Court of Georgia, 16 S. E. Rep. 220.

A STATE ROAD CONVENTION IN MARYLAND.

The Deer Creek Farmers' Club, of Harvord county, Maryland, being assured of influential co-operation, has issued a call for a state road convention, to be held on Wednesday, January 15, in the hall of the Young Men's Christian Association building, Baltimore. The chief object of the convention is to organize a State Road League, with branches in every county, for the purpose of increasing the interest already awakened in Maryland in behalf of good roads.

COST OF FIRE BRICK PAVING.

The cost of laying 13,224 square yards of fire brick paving in Wilmington, Del., during the fiscal year 1891-2, as given in the last annual report of the street and sewer department, was $2.10 per square yard. Most of the paving was on stone foundation and most of it was tarred. Some of the paving which was not tarred was grouted. On the different streets the per centage of loss of bricks per square yard varied from 1 9-10 to 4½ per cent. Nearly all the brick used averaged about $18.50 per thousand in cost, but some were bought for $14, all delivered at Wilmington.

PERSONALS.

Mr. Drexilius is now at the head of the water-works of Buffalo, N. Y.

Mr. J. W. Kendrick has been elected city engineer of Birmingham, Ala.

Mr. Jno. H. Dockweiler has been re-elected city engineer of Los Angeles, Cal.

J. C. Stearns has resigned as superintendent of the city water-works of Charles City, Iowa.

Mr. Geo. E. Mann, for many years city engineer of Buffalo, N. Y., is succeeded by Mr. S. J. Fields.

Mr. Albert Smith, of Saltsburg, Pa., has in charge the main sewer construction of Corry, Pa., which has been resumed after a six months' delay on account of a defective city charter.

At the meeting December 7 of the American Society of Civil Engineers, the following candidates were elected: Members—Wm. H. Brown, Philadelphia, Pa.; Howard Constable, New York City; Edmund J. Spilsbury, Trenton, N. J. Associate Members—Henry F. Baldwin, Chicago, Ill.; Edward F. McConnell, Indianapolis, Ind.

The following are the officers for 1893 of the Engineers Club of St. Louis, as elected December 7: President, Robert Moore; vice-president, B. L. Crosby; secretary, Arthur Thacher; treasurer, Charles W. Melcher; librarian, R. E. McMath; directors, J. B. Johnson and Geo. H. Pegram; members of board of managers, J. B. Johnson and J. A. Baird.

A NEW KIND OF PAVING BRICK.

The Toronto Chemical Smelting Company, of Port Colborne, Ontario, Can., is about to manufacture hard, black glass building and paving brick. The material is obtained as a result of the use of a new patent process of reducing and refining nickel from the ores, and would, unless utilized in this manner, be an absolute waste. It is claimed for these brick that they will be extremely hard and durable, and especially adapted for paving purposes. One of the streets in Port Colborne will shortly be paved with them.

TO PROTECT STREET PAVEMENTS.

Upon the recommendation of Capt. Fiebeger the following article will be added to the police regulations of Washington, D. C.:

"That no person shall deposit on any asphalt or concrete pavement any building material, unless the pavement is covered with a close fitting platform of boards."

LETTERS FROM THE PUBLIC.

THE NOMENCLATURE OF ASPHALT PRODUCTS.

To the Editor of Paving and Municipal Engineering:

SIR—I have carefully read, in your valuable magazine of October last, an article entitled "The Nomenclature of Asphalt and Bituminous Products," by Leon Malo, Consulting Engineer, Pysimont, Seyssel, France, translated by W. H. Delano, Paris.

Mr. Leon Malo seems to be quite surprised that his nomenclature of asphalt and bituminous products proposed by him since about thirty years ago is not adopted.

The proposition of Mr. Malo is to call *asphalt* all natural products of carbonate of lime with bitumen, while the proper adopted term is *bituminous limestone* or *bituminous carbonate of lime.*

I am ready to prove that his proposition is devoid of logic, clearness and scientific principles, and that his proposed classification would create an embarrassing confusion. Thus it is no wonder that the scientific world adheres to the clear and comprehensive language as found in all good dictionaries, encyclopedias and adopted all over the world by our great standard authorities.

Now let us see if Mr. Malo's proposition is logical and has for a guide the principle of science.

As the science of chemistry progressed its nomenclature was changed accordingly. These changes had always for principle clearness for the adoption of its terms by which the composition of a compound is expressed. For instance, by the term *carbonate of lime* ($CaO\ CO^2$) we learn that the mentioned compound is composed of lime and carbonic acid ($CaO+CO^2$).

By using the wording *bituminous limestone* or better, *bituminous carbonate of lime*, it is perfectly understood that this natural or artificial mixture is composed of *carbonate of lime* (*limestone*) *and bitumen.* Now if Mr. Malo's proposition was adopted, by calling the above mixture *asphalt*, the result would be a confusion of language. Since, when consulting our best dictionaries, encyclopedias, etc., we learn that the name "asphalt" is not only known since about 40 years ago, but is applied since ages to certain natural hydrocarbons with which carbonate of lime has no relation. It is true Mr. Malo makes a statement by saying, "When bitumen impregnates limestone, naturally the product is asphalt." This theory not only is devoid of science, but it is ridiculous, at least to those who possess some knowledge of chemistry. It seems that Mr. Malo has been guided by some unknown and unexplained erroneous idea, to bring forth such an illogical term as asphalt for bituminous limestone.

Mr. Malo ought to know that when bitumen impregnates carbonate of lime the carbonate of lime and bitumen remain unchanged, no chemical reaction takes place between the two compounds, and consequently the statement of Mr. Malo lacks reason and is not true.

The conclusion we reach is that to call bituminous limestone asphalt would distort the term asphalt from its primitive and true meaning.

Mr. Delano appears to dislike the terms of asphaltum and asphaltic cement. This being a question between Mr. Delano and all dictionaries, I have nothing to say. His proposition ought to be addressed to the authors of these useful books.

E. J. DeSmedt, Chemist.

New York, December 14, 1892.

To the Editor of Paving and Municipal Engineering:

Sir—Your correspondent who writes upon the classification of asphalt in your issue of November, can call Trinidad pitch, composed of 33 per cent. water, 33 per cent. fire clay (which can not be eliminated, being of the same density as the pitch), and 33 per cent. pure pitch—asphalt—but that does not alter the fact that asphalt is bituminous limestone. His knowledge of this special question is recent—too recent and complete.

Here, there are people who call gas tar, shale grease and petroleum, still bottoms, asphalt, with just as much reason.

I have never seen your correspondent, Mr. Gibson, so I never got him to do anything; he can no doubt defend himself.

When in New York last July, I asked the authorities to be allowed to bid for natural asphalt roadways, as the Trinidad pitch compound laid in Paris under Mr. Schubert's superintendence had broken to pieces. I was told I could bid, but it would be difficult to send orders to Paris. That is why my company has bought land and put up machinery at Hunter's Point, Long Island City. The steam engine, boiler and ordinary plant are of American manufacture, and next year we hope to start an American company with an American Board of Trustees, and an American manager, and show better work than has ever been done before.

The town of Berlin has nearly 1,000,000 square yards of compressed asphalt; London, 600,000; Paris, about 500,000.

We shall exhibit class 12, mining produce, in French section at Chicago exhibition, and I am preparing a little book giving my experience with natural asphalt for over twenty years, which may perhaps clear up some misconceptions, and Mr. Malo has painted a 15 foot high oil picture, to show what the Seyssel asphalt mines are like inside. We shall show models of all that can be done in asphalt and mineral bitumen.

Paris, Dec. 9, 1892. *W. H. Delano.*

FOUNDATION AND CONSTRUCTION OF BRICK PAVEMENTS.

To the Editor of Paving and Municipal Engineering:

SIR—Having read with much interest the able reply to a citizen of Knoxville, Tenn., by Mr. Charles P. Chase, of Clinton, Iowa, to an inquiry as to the merits of brick pavements, published in the December number of your magazine, I wish to particularly commend one or two points made by Mr. Chase:

First—As to foundations. Experience in this city confirms the fact noted by Mr. Chase, that a pavement *"satisfactory in every respect"* can be made without either the costly concrete foundation or the double course of brick so generally adopted for brick pavements. We have our street paved with a single course of brick, as described by Mr. Chase, except that well-rolled gravel was used in place of broken stone.

At the time the improvement was in progress public sentiment very generally condemned the judgment of the engineer in admitting this foundation in the specifications. After over a year's traffic this street has a much better surface than that of an adjoining street, which was paved with two courses of brick and at a cost greater by 30 per cent. than the single course. I have recently compared the surface of this single-course pavement on gravel foundation with brick pavements in other cities and believe it is at least as good as, if not *better* than, those on concrete foundations. To-day public sentiment in this city is as pronounced in favor of this foundation as it was in opposition to it when it was first proposed.

I do not wish to advocate a cheap foundation simply because it is *cheap*, but if the cheaper foundation is as good as, or better than, the more costly, it is important that this fact be more generally known.

Second—This city is the only place, so far as I have been able to learn, where the courses in brick pavements are *not* laid at right angles with the street. The top courses on *all* brick pavements in this city are laid at an angle of forty-five degrees with the course of the street. This was done for the reason that I had noticed that plank on bridges laid in that manner wore longer and made a smoother surface, with less jar to passing vehicles, than when the plank were at right angles with the bridge, and it seemed reasonable that the same would hold good in relation to the courses of brick pavement. It has been a matter of surprise to me that others have not adopted the forty-five-degree angle in brick pavements, and have thought perhaps there was some reason for adhering to the right-angled courses that I was not aware of. It was, therefore, a source of no little satisfaction to note the recommendation of Mr. Chase that *all* brick pavements be laid at an angle of forty-five degrees, and the statement that at street intersections, where they were so laid, the pavements were wearing better than where laid at right angles.

The point made by Mr. Chase that it is not essential that a brick should reach the point of fusion (be vitrified) in order to make a good paver, is also well taken, as is shown by experience in this city, unless that point is reached sooner than is generally supposed. I noticed that brick that have not taken the color usually supposed to indicate vitrification become very near impervious, and are tough and appear to stand as well as those that are unquestionably vitrified. But of course clays may differ in this respect.

William M. Whitten.

South Bend, Ind., Dec. 17, 1892.

THE IMPORTANCE OF WIDE WHEEL TIRES.

To the Editor of Paving and Municipal Engineering:

SIR—In your issue for November Mr. Macklind, in his article on "Street Paving in St. Louis," reports, with seeming approbation, the extensive use of granite pavements "for manufacturing and mercantile traffic." He says of asphalt: "While it has been subjected to the heaviest loads hauled in the city with fair results, it must stand below granite for wear."

The cost of traffic over almost any street or road surface—that is, the cost of wearing out such surface—is greater than the cost of keeping up the surface under traffic. However little granite is worn by traffic, the cost of this wear to owners of horses and vehicles or to the community at large is many times greater than the cost of wearing asphalt or brick even as much faster as they are said to wear.

Mr. Macklind speaks of brick pavements failing "under the conditions of traffic," meaning its use by "commercial teams." Why not change the conditions, which are all wrong. Commercial teams really mean the hauling of *still heavier loads* on wheels (tires) already much too narrow for light traffic vehicles.

I quote again: "It being a self-evident proposition that the drier the roadway the longer the life and the more efficient the service, at the lowest cost of maintenance it remains to provide for the elimination of dust and mud from the problem of good streets. The first step in this direction is perfect cleaning."

It is much more important to know and say that the greater the tire width the longer the life of the roadway, whether dry or wet, the less its cost and the less the greater cost of wearing out the surface; that is, the cost of traffic over the surface. What we most need is to know how to reach the lowest cost of maintenance, which is in effect the first and by far the longest step in the direction of cleaning, since it obviates the necessity for most of the cleaning now required. Manifestly broader wheels tend to prevent dust and mud and their attendant cost, tend consequently and correspondingly to prevent traction or cost of hauling, besides tending to lessen both first cost and maintenance, cost of pavements and road surfaces. Even "heavy traffic" should be facilitated, and just as much so as light traffic.

It is pretty generally admitted that asphalt facilitates both light and heavy traffic most *while it lasts*. Now, the fact is that asphalt pavements can be perpetually maintained for and at the capitalized first cost of granite pavements in St. Louis and Memphis and most other places.

With adequate tire widths no doubt enough money could be saved in cost of wearing or using streets and roads to pay for keeping up the street and road surfaces (including all expenses) of whatever material they may be made. Now, since "heavy traffic" (meaning always destructive traffic) is simply the very expensive bad practice of using narrow tires, why should we not stop the practice and do away with even the alleged necessity for granite pavements?

Granite makes traffic from three to ten times as "heavy" as it is on asphalt, and the present narrow tires make traffic very much "heavier" on any pavement or none than it needs to be.

J. M. Heiskell, M. E.

Memphis, Tenn., Nov. 21, 1892.

SELECTIONS FROM THE PRESS.

BRITISH AND AMERICAN BRIDGE BUILDERS.

The larger bridges on the Transandine Railway are of American construction. The reason for this is certainly interesting, as it raises an important point on the relative value of American and British bridge building practice, and shows how that practice operates in the matter of securing foreign orders, or orders for foreign countries, which is not quite the same. Time was an important element in the matter; the railway was practically completed, but could not be opened until the bridges were constructed and in position.

Several British bridge-builders were therefore asked to state the time they would require to build a bridge of 246-foot span, and the shortest time was eight months. A cablegram to American firms brought the reply from two that they would deliver all the four bridges of the size required alongside a vessel at New York in eight weeks, while a third asked twelve weeks. There was no alternative. Cables were again sent to the three firms stating the load and the tests to be made when the bridge was in position, and offers were at once sent. The span we have given; the tensile strength of the steel used was to be from 26 to 30 English tons (58,240 pounds to 67,200 pounds) per square inch, with an elongation of 20 per cent. in 8 inches before fracture. The builders were to guarantee that the bridges satisfied the test requirements when in position. The main girders were to be 15 feet 1 inch, c. to c., to carry the single line of meter gage (3 feet 3⅜ inches). Here are the offers:

Tenders for Bridge of One Span, 246 feet.

Name.	Price £.	Weight, tons.	Per ton £. s. d.	Cents per lb.	Deliv. wks.
Union Bridge Co.	2,515	156	16 2 0	3.85	12
Phœnix "	2,637	156	16 17 8	4.01	8
Edge Moor "	2,493	164	15 3 5	3.29	8

Time, as we have said, was the consideration, and weight was an important element in view of the distance the bridge had to be conveyed inland, so that the Phœnix Company got the order, although their price was highest. It is interesting to note that the changing of the material from iron to steel only involved an increase of 5 per cent., the tests being as above, and it is further noteworthy that the Phœnix Company wished the truss to be 35 feet deep, and offered to make the price less with it than with a 32-foot truss.

The point suggests itself: How could the American firms offer to build the bridge in as few weeks as the English firm required months? The reply is simply that their system of bridge-building enabled it to be done. Here the builder gets his drawings from the railway engineer, who designs every rivet and bolt, if he does not specify how the rivet or bolt is to be driven. A. B. wishes one style, C. D. an entirely different type, so that the builder must be prepared for anything—the advocates of the American system might say for nothing. In America, on the other hand, the builder designs the bridge, or rather, he has a standard type, and the engineer only needs to state requirements. The firm can therefore have special machinery for rolling their iron or steel to the standard sections needed and are thus independent of steel makers. They are, therefore, prepared in the fullest sense of the word. It may be urged that the British system admits of greater choice of design and therefore suits British needs; but after all it is to the foreigner we, in large measure, have to look for orders, and, as a rule, he is satisfied with what he can get quickly and cheaply, provided it meets the desired conditions as to load and tension and compression tests. We do not enter into the relative value of American and English designs, or as to whether American or British prices are lowest. Our contention is that there are most convincing evidences that the American practice has its advantages. As to relative prices, it is to be regretted that in the case of the 246-ft. span quotations were not got from

English as well as American firms; but Messrs. Clark's business was not to collect proofs on economic points. Fortunately, however, the idea suggested itself, presumably for other reasons, to get an English firm to quote a price for a 197-ft. span from sketch drawings supplied by an American firm who had tendered, so that we have in this case comparative prices:

Quotations for 197-ft. Span.

	Price.	Weight.	Price per ton.	Price per lb.
	£. s. d.	tons.	£. s. d.	cts.
Pencoyd B'dge Co.	1,679 13 0	117¾	14 5 0	3.09
British firm.....	2,025 3 0	138	14 13 6	3.18

It will be noticed that the British firm (which need not be named) assumed a greater weight—that is, in accordance with practice—and that their price per ton was greater, notwithstanding that material and wages are said to be dearer in the States. Of course, the American firms have special machinery. This, however, one may find in almost all concerns.—*Engineering, London.*

HOW TO TEAR UP A STREET.

One of the most marked things in European cities to the American traveler is the frequent evidences of the employment of highly skilled labor upon work which would be done by unskilled labor in this country. A city official of New York said a short time ago it would be impossible to keep the streets of New York in a state of cleanliness and repair similar to the boulevards of Paris because of the expense, which the tax-payers would not stand. And he went on to say that, granting the tax-payers were willing to stand the expense, the needed number of skilled laborers could not be found. But in Paris such things can be done quickly and skillfully, because a large force, an indefinitely large force, of highly-skilled laborers may be hired for a small sum. The result is that even the humblest work is done with an exercise of skill and intelligence which amazes an American. When a street or building is to be repaired a great force of trained laborers is gathered, the materials for labor come with them, and the work goes forward swiftly, quietly, in an orderly manner, with so little muss and fuss that passers-by are hardly conscious that anything is doing.

An American drinking a small bottle at a little table in front of the Cafe de la Paix one day last summer saw an illustration of this. As he discovered later on, a gas-pipe four or five feet below the level of the asphalt, not far from the curbing, was in need of repair. Toward 10 o'clock a man with a spade, a hammer and a chisel appeared with an assistant, who carried two great baskets. The two laid down their tools, and one of them took from one of the baskets a rope and a number of iron standards, sharp at the lower ends. Quickly the men drove these standards into the asphalt and stretched the rope around them so that a square space eight feet by four was inclosed. The assistant took from the basket a big placard and leaned it against one of the standards and went away. The placard was an announcement that the laborers had permission to take up the asphalt and repair a gas-pipe.

The other laborer climbed over the rope and marked out upon the asphalt a square six feet by two and a half. Following this mark he chiseled through the asphalt, and when he had separated the piece inside the mark he carefully lifted it out and laid it to one side. Then he took his spade and dug up the gravel and other stuff that formed the immediate foundation of the asphalt. This material he put into one of the baskets. Then he attacked the earth underneath, and soon had his hole dug to the required depth, with the gas-pipe exposed. All the dirt he had taken from the hole was in the other basket. If there had been a fine carpet up to the edge of the hole on all sides it would have been only slightly sprinkled with soil and not at all injured.

When he had done he gathered up his tools and looked impatiently up the street. His face cleared at once and broke into a smile of greeting as two laborers, armed with tools and a basket, appeared. He left them and went away. They were evidently plumbers and understood their business, for in almost no time at all the pipe was fixed and the plumbers were standing outside the rope looking about them. They did not have long to wait. The laborer who had dug the hole reappeared and they went away. He proceeded with the greatest care, but very swiftly, to

put back the earth and to ram it down with a rammer he had brought with him.

Just about the time he began to put back the gravel a roller and engine appeared. Another laborer climbed over the rope and helped him with this last work in which hot tar was used. They laid back the piece of asphalt which had been cut out and laid aside, and filled in the crack. Then they pulled up the stakes and threw them into one basket and the placard into the other, the roller passed over the place two or three times and then they all went away, leaving no dirt, no muss, and only a square line of a slightly different color from the rest of the asphalt to show that anything had been done. The American who was watching all this looked at his watch. It was not quite 12 o'clock. The work had been done in about two hours. The street had not been blockaded. No great and unsightly piles of dirt had been thrown up, the blouses of the laborers were as clean when they went away as when they came. The street was as perfect as if it had not been disturbed.—*New York Sun.*

ELEVATED SIDEWALKS.

Considerable interest has been shown in many quarters at the suggestion already started of a system of elevated sidewalks in Boston. It was pointed out at the time that the scheme offered an apparent solution of several of the most perplexing problems in street traffic. Another point that was not touched upon was the fact that the under side of the elevated walks could be utilized for the stringing of wires.

John A. Seaverns, an electrical and mechanical engineer, says that the whole plan, as outlined by its originator, S. D. Hannah, of the real estate firm of S. D. Hannah & Co., is worthy of close consideration, and that the solution of the wire problem which it offers is the best that has yet been suggested. He thinks that with such a system of sidewalks the entire wire system, now run either overhead or underground, could be strung in cables of from one to two hundred wires along the under side of the elevated walks, with distribution boxes at the corners of the streets, whence all wires could be carried into the different buildings without being exposed, and also without necessitating the stringing of long wires from distant points, as is now so often the case. A single company could be formed for the purpose of stringing the cables and keeping them in thorough order, and then any company or individual needing wires could rent as many as might be required at a price which would be much less than the present cost to all the different companies that have their own systems and undergo great expense in keeping them in repair.

The city could charge a rental for the use of the under side of the walks for stringing the cables, and the revenue thus derived would go a great way toward paying the interest on the entire cost of the undertaking. Such a wire system could be nearly perfect, as storms could not affect the cables, and there would be no loose, dangling wires to interfere with traffic and perhaps endanger the lives of passers. Added to these advantages would be the clearing away of the network of wires which now obstructs the streets overhead, and so mars the prospect, and the removal of the constantly multiplying number of posts and poles that line the edges of the surface sidewalks.

With regard to the system of pipes by which the elevated walks could be kept clear of snow, it is suggested that the steam connections could be made in sections, just as is now done on the roofs of many buildings. Alternate sections of about four feet in width could be supplied with pipes and filled in with fire-clay, the sections in between being made of perforated iron plates with glass bull's eyes running down about three inches and having the lower end cut at an angle, so as to multiply the light entering through them as much as possible. No extra expense would be incurred in supplying steam for such a system, as one can readily see by looking out from one of the higher windows in one of the new tall office buildings and noticing how numerous are the waste pipes about the city from which the "exhaust" steam is escaping all the time.

Another advantage which the elevated sidewalks have over the arcade plan is that open spaces can be left at regular intervals between the walls of the buildings and the

walks, thus allowing considerable additional light to enter the store windows below. The stay wires of the electric car system could also be attached to the supports of the elevated walks and thus the poles now needed could be removed. Not the least of the advantages to be gained by such an elevated walk system would be the perfect freedom to walk straight on to your destination without having to stop at every crossing to let cars and carriages and trucks go by.—*Boston Transcript.*

LOUISVILLE'S DEMAND FOR GOOD STREET PAVEMENTS.

Modern ingenuity will yet devise some durable, noiseless and economical pavement. Millions are annually spent in American cities with results that at present are far from satisfactory. Granite, well laid, is durable, but is intolerable on account of the noise. One remedy would be rubber tires, and the world is coming to rubber tires.

In London it is no uncommon thing to see the best cabs with rubber tires. The record of Nancy Hanks will give a new impetus to this change, and though the wagons for heavy traffic may see no benefit in them, all pleasure and passenger traffic will in time be carried on rubber tires. In this way you carry your asphalt around with you.

The asphalt pavement is smooth and noiseless. On the other hand it is dusty, expensive and not durable. It requires constant repairs, and repairs are rarely satisfactory. We speak only of asphalt in Louisville. That it might be made more satisfactory we believe; that here it is very far from satisfactory is not to be denied.

Asphalt blocks, or blocks of some composite character, would have evident advantages over the ordinary asphalt, if they could be made at a reasonable figure.

Vitrified brick is a new material for street pavements. If made with proper care, and if inferior material be rejected, brick will, we believe, be an excellent substitute for macadam, and the indications are that brick will, in this climate, meet with the requirements better than asphalt. Time alone can determine this. Success depends first on the use only of the best quality of brick, and second on the manner in which the brick is laid. A good foundation is essential to a good pavement of any material.

Wooden blocks were discarded some years ago as unsuitable, but experience and observation seem to show that the fault was not so much with the wood as with the foundation on which it was laid.

Wood blocks will not do for very heavy traffic, perhaps, but no pavement for ordinary traffic is more delightful than wood. But here we put wood down on a foundation of sand or clay, covered with a thin pine board. It might be well to try wood on a concrete foundation, such as we prepare for granite and for asphalt; such as we should prepare for every pavement. Let the foundation be laid once for all; it will then suit any covering.—*Louisville Courier-Journal.*

THE GENERAL DEMAND FOR VITRIFIED BRICK.

The rapid growth of brick pavements throughout the country is but another evidence that the people are awaking to the fact that vitrified brick is the proper material to be used in roadway paving. It provides a smooth and durable wagon track that is not likely to get out of repair and can very easily be kept clean. In all of the cities and towns where brick pavements have been put down they have given the most complete satisfaction. This is particularly so in the West and Northwest, and in the larger cities where the traffic has been unusually heavy the pavement shows no evidence of the wear and tear of heavy teaming. In the city of Davenport, Ia., the council recently passed a resolution to pave twenty-four of the principal streets with vitrified brick, and the work will be started in the spring. They will use a broken stone foundation with one layer of brick upon streets where the traffic is light, but upon business streets the same foundations will be used with a double course of brick. Des Moines, Ia., has entered into a contract to pave every street in the city with brick, made right on the spot. All over the country the desire for this class of paving is on the increase, the latest converts coming from

the South, as the cities of Baltimore, Md., and Roanoke and Alexandria, Va., have decided to use it. Chicago is already in line, and it has been demonstrated to the city authorities that brick is proving to be the best paving material. The granite blocks used on our principal streets do not give satisfaction. They may be durable, but are generally rough, noisy and difficult to keep clean. Brick, therefore, is the proper solution. That this is the state of the case is evidenced by the large number of paving brick plants which are being put up all over the country. The demand for this character of pavement is so great that the capacities of the various vitrified brick plants have been tested to the utmost and in a number of cases they have been unable to fill their orders.—*Clay Record.*

MACHINERY AND TRADE.

BRICK DRYING.

As the history of brick machinery has been a record of constant improvement, likewise has that of its most important adjunct—the drier.

While a few years ago an artificial drier was considered a questionable investment, and at best an expensive luxury, it is not so regarded to-day; but, on the contrary it is an indispensible necessity, which no wide-awake, progressive concern can afford to be without.

Numerous processes have been tried in the past, with varied success; some have proved absolute failures, and have disappeared from the scene of action, while others have been found either too expensive for general use or too crude to fill the requirements of a successful and practical brick drier.

The limited success which has been met with thus far in the drying of clay products is attributed to a lack of study of heat radiation and other well-defined principles involved in the science of drying.

To dry brick and like material economically and rapidly, the air with which they are brought in contact must be heated to the maximum degree, that the nature of the clay will stand without injury.

When it is taken into consideration that an increase in temperature of twenty-five degrees renders the air capable of absorbing about double the quantity of moisture, it is evident that the greatest economy is attained when all the heat is applied that the nature of the clay will warrant. The idea that heat alone will dry is, however, an erroneous one, and has been the cause of many disappointments. Science proves that the principle office of heat in any drying process is simply to increase the capacity of the real medium, which is the common atmosphere.

Air, as a fixed or stationary body, will absorb moisture in proportion as it is expanded by heat. But it has a limit at which its drying power ceases. This is called the point of saturation.

It becomes necessary, then, to replace it with drier air. In doing this, nature's own methods should be followed. This involves no new and untried principles or complex theories; the only means required being such as shall create a circulation that is continuous and sufficiently rapid to prevent the air reaching the point of saturation. The nearer that point is reached the slower will be the process of absorption. This is the theory of drying faster on a windy day than on a calm one.

The most practical method of maintaining a positive circulation of the air is by mechanical means, involving the use of a fan of the blower type.

The factors in drying, then, are heat and air; the one to evaporate the moisture and the other to absorb it.

A perfect system of drying involves, however, something more than the mere application of the elements of drying to the green brick.

The impression has prevailed, it would seem, that all kinds of clay products should be treated alike, and for that reason no adequate provision has ever been made to change the conditions to suit the different varieties of clay. It is perhaps to this fact, more than to any other, that the artificial drier in the past has in so many cases proved a failure.

Another difficulty encountered in drying, by whatever method, has been the inability to control the hot air currents; that is, to maintain the same degree of heat at the top, center and bottom of drier.

The natural tendency of hot air being to rise, the temperature in most driers (both steam and furnace heat) is considerably higher in the upper part of the room than at the center and floor line, resulting in not only greatly retarding the drying process, but also injuring the quality of the

product owing to the varying temperatures to which the material is subjected.

It is evident, in the light of past experiences, that the drier of the future, in order to fully meet the requirements of the various clay products now on the market, must, in the first place, be susceptible of perfect regulation. 2d. The heating arrangement must be such that the air can be heated to the maximum degree that the nature of the product to be dried will warrant, in order that the drying may be done rapidly and economically. 3d. Some positive means must be provided for maintaining a uniform circulation of the heated air, for the reason that if it becomes irregular it causes an uneven distribution of the heat, promotes unequal expansion and consequent cracking and retards the drying process. 4th. The air currents must be controlled so that all parts of the material are subject to a like degree of heat. 5th. The ventilation of the drier must be so governed that the moisture or water smoke can be gotten rid of at will, or retained as circumstances require.

A candidate for public favor filling these requirements, is the Standard Patent Forced Draft Drier, manufactured by the Standard Dry Kiln Co., Louisville, Ky. It has been particularly successful in drying paving brick.

A LEAD-LINED IRON WATER PIPE.

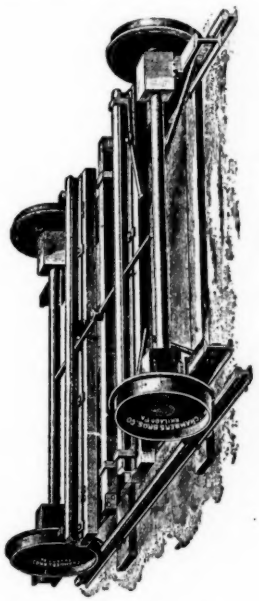
A lead-lined service pipe has been devised by Mr. George W. Harrington, Superintendent of the Wakefield (Mass.) Water Co., and is now being manufactured at Wakefield by the New England Water Pipe Co. This pipe is designed to give all the advantages of lead pipe without using the large amount of lead which is necessary for pipe under heavy pressure.

In manufacturing the pipe ordinary iron pipe is used. In this a thin lead pipe of smaller diameter is inserted and then expanded to fit the iron.

When a length of pipe is cut the exposed ends of iron are protected with lead. A tool is inserted in the end of the pipe to press the lead against the iron. A thimble is then inserted and driven home by the tool, which trims off all surplus lead and forms a lead bead at the end of the pipe. When a thread has been cut on this pipe and the pipe screwed into a fitting, the thread on the fitting screws against the beaded end of the thimble, so that no part of the pipe is exposed to the action of the water.

A NEW TRANSFER CAR FOR ARTIFICIAL BRICK DRIERS.

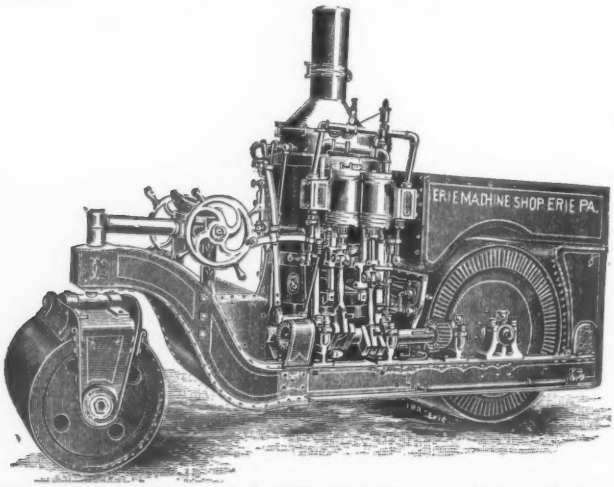
This transfer car is designed for hard usage, and to withstand the rough handling to which this adjunct of the modern brick-drier is subjected in large works where hundreds of car-loads of bricks are transported daily. The body of the car is made of wrought iron beams braced by heavy cross-rods. The axles are of two-inch



iron, with turned journals running in a packed lubricated box. The wheels are keyed to ends of axles, and when worn can readily be renewed. The car has a substantial lock-bar, operating at either end of the car and moved by forged iron foot levers. All of the fittings of the car are forged, and there are no light castings to be broken by a kick from a heavy boot on a frosty morning. The manufacturers are Messrs. Chambers Bros. Co., Philadelphia.

THE ERIE STEAM ROLLER.

The Erie Steam Road Roller is made as nearly as possible of wrought iron and steel. The main frame is made of ½ in. by 9 ft. steel channel beams, strongly braced with cross beams of the same



material and shape, and well riveted together. The small front rollers are 30 in. diameter; two of these rollers are placed together on one axle, revolving independently of each other, making a continuous drum 39½ in. wide, and is of ½ in. steel plate. The large roller is 48 in. diameter, 39½ in. wide, and is made of ⅝ in. steel plate. The shaft of large roller extends through the entire length, and is 4 in. diameter. In case it is desired to load the roller heavier, the weight can be put on shaft on the inside of roller, thus having the weight on the bottom and not making the machine top heavy. There is also a universal joint at the front of the machine, in which the vertical pivot, corresponding to the king bolt in carriages, allows the front axle to assume any angle with the axle, thus doing away with all twisting strain on the frame.

There are two 6 in. by 6 in. high pressure reversible engines. The connecting rods and crank shaft are made of the best hammered iron. The segments on large roll and the driving pinion are made of steel. The front bearing in goose neck is made in two parts, in order that the bolt may be taken off without any trouble. A small tool box is placed in front of the machine for the convenience of the operator, where wrenches, waste, etc., can be kept.

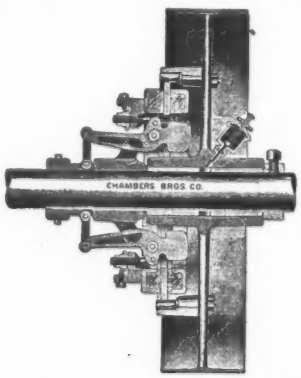
The steering gear is made of one steel screw with brass nut, is very quick and strong, thus dispensing with the expense of keeping in proper order a combination of gear wheels, chains, etc.

The boiler is vertical, made of steel, and is of the best workmanship. Handholes are freely provided for washing-out purposes. It is fed by either pump or injector, and is jacketed with asbestos and Russia iron. All bolts are double nutted, thus preventing loosening on the road.

The manufacturers have made some changes in the roller during the last year. The frame is longer and made of heavier iron. The large roller is heavier and also the goose neck. The head block is made in two pieces and some other changes have been made, all greatly improving it.

FLEXIBLE FRICTION CLUTCH.

This new flexible friction clutch, as applied to driving pulleys, is illustrated in the following sectional view, and is believed to present several points of superiority over the various styles of friction clutch pulleys now on the market. Among



the features peculiar to this clutch are the following:

First. A friction disc flexibly connected

at its outer edge to another part of the device. This arrangement admits of the pulley running out of true without straining the clutch, and also admits of the inner clutch member being rigidly fastened to the shaft, the outer clutch member alone being movable. It also insures the pressure of both of said members being equal under all conditions.

Second. The inner clutch member being rigidly fastened to the shaft admits of the levers being fulcrumed to said member, and these levers are so connected to the outer clutch member as to render absolutely positive the releasing of the clutch. No springs of any kind are employed.

Third. Each lever being balanced on each side of its fulcrum, so that at the highest speed centrifugal force has no tendency to either cause or resist the movement of the levers.

Fourth. In comparison with clutches having four or six pairs of clutch members, all of which, to be efficient, must move in unison and bear with equal pressure on the opposite sides of a rigid cylinder. The "Waldron" has only two clutch members, but one of which moves, and thereby transmits its pressure against the disc to the opposite member. In the style of clutch under comparison, the load strain has a tortional effect on its clutch members, while on the "Waldron" the strain is in line with the resistance.

Fifth. All parts of the "Waldron" clutch being balanced, there appears to be no reasonable limit to the speed at which it may be run with safety.

Sixth. The "Waldron" clutch has but few parts, and having a very large gripping surface in proportion to its diameter, enables one to use in comparison with other clutches a smaller diameter of "Waldron" clutch for the transmission of a given horse-power. The "Waldron" thus not only weighs less than other styles, but the weight is close to the shaft, making a decided advantage in its favor on high speed work.

Seventh. It occupies the least amount of room on the shaft. The clutch is constructed in the best possible manner, the parts are interchangeable, and it has been tested under trying circumstances.

This clutch is made by the Chambers Brothers Company, of Philadelphia, and is being placed by them on their brick-making machinery.

NOTES.

The new catalogue of the Frey-Sheckler Co. is ready for distribution.

The Frey-Sheckler Co. has sold an Acme brick machine outfit to the Sioux Paving Brick Co., Sioux City, Ia., and a complete plant, comprising brick machine, crusher, pugmill, cutting tables, elevators, trucks, etc., to the Columbian Brick Co., Connellsville, Pa.

Attention is called to the new advertisement of The Decatur Leader Manufacturing Co., Decatur, Ill., who have placed on the market several new machines and appliances for the manufacture of brick. Cuts and detailed descriptions will shortly appear in these columns. Printed matter may be had by addressing them.

The Frey-Sheckler Co. have sold a steam power re-pressing machine to B. Kreischer & Sons, Perth Amboy, N. J. This is the second press sold these people in the last six months. They have also received an order from the Fort Smith Paving Brick and Fire Clay Co., of Fort Smith, Ark., for two of the steam power re-pressing machines.

J. W. Penfield & Son, of Willoughby, Ohio, have issued what they call "A Condensed Catalogue for Busy Brick-Makers," briefly enumerating their large variety of manufactured products. This is the eighth of their series of handsomely printed catalogues relating to their machinery and the interests connected with their busi-

ness, any of which they will send on application.

The Frey-Sheckler Co. sold a No. 2 Bucyrus Giant brick machine outfit to H. N. Zapel & Bro., Chicago, Ill. This makes the twelfth outfit of machinery they have shipped to Chicago since January, 1892. They sold a Mascot machine, with hollow block outfit, to A. J. Haws & Sons, Johnstown, Pa. This is the second outfit sold to these people in the past year.

On a trip to Cincinnati recently a representative of PAVING AND MUNICIPAL ENGINEERING was shown some specimens of paving brick which were extremely hard, dense and heavy, and upon breaking one of these brick and examining it under a strong glass found it to be fully as dense at the center as on the surface, there being no trace of either checks, grain or lamination. These brick measured 8½x4¼x2¼ inches and weighed eight pounds each, absorbed less than one-quarter of 1 per cent. and stood a crushing strain of 13,000 pounds to the square inch. They were made from very stiff clay, on the "Grant" brick machine, without re-pressing, and were apparently excellent pavers.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Marion, Ohio, is discussing the paving question.

Camden avenue, Canton, Ohio, will be improved.

Brick street paving is being done in Redlands, Cal.

A number of streets in Dayton, Nev., are to be paved.

The main street of Charlotte, Mich., is to be paved.

Golden avenue, Colfax, Neb., will be paved with brick.

Goshen, Ind., will pave its principal streets with brick.

Main street, Venice, Mo., will probably be paved with brick.

Rock Island, Ill., will spend $100,000 in brick paving this year.

A move for better pavements is being made in Madison, Wis.

Jacksonville, Ill., has now twelve miles of finely paved streets.

Several streets in Clarkes, W. Va., are to be paved with brick.

Twenty additional streets will be paved with brick in Toledo, O.

Taylor avenue, Bellevue, Ky., is to be extended and improved.

Ten miles of street paving will be done this year in Streator, Ill.

Deadwood, S. Dak., is improving Forest avenue at a cost of $3,000.

About $300,000 were expended in paving last year in Des Moines, Iowa.

About $7,000 has been expended improving the streets of Comanche, Tex.

Springfield, Ill., business men will establish a $100,000 paving brick plant.

The principal streets of Richmond, Mo., are being graded and macadamized.

Parts of Chicago, Glor and Milburn streets, Buffalo, N. Y., will be paved.

North Second street, Brooklyn, N. Y., will be widened at a cost of $323,000.

Main street, Kenosha, Wis., will be paved and curbed at a cost of $16,340.

Milwaukee and East Eleventh streets, Portland, Oregon, will be macadamized.

Central avenue, from Seventh to Fourth streets, Alamedo, Cal., is to be improved.

Fifty thousand dollars will probably be expended on roads at New Rochelle, N. Y.

Erie street, Jersey City, N. J., will be graded, curved and paved with Belgian block.

The city of Pekin, Ill., is considering the means of raising $27,000 to be used for paving.

The Tampa (Fla.) council has ordered the grading of a number of streets and avenues.

Broadway, De Forrest, Bush and South Fifteenth streets, Seattle, Wash., will be improved.

Proposals will be received until Jan. 6 for the brick paving of Main street, Venice, Ill.

Fort Howard, Wis., has spent about $80,000 for paving and sewers during the past season.

A movement has been started to have Fremont street, Fostoria, Ohio, paved and boulevarded.

Three streets are to be opened between Central Park avenue and Garfield Boulevard, Chicago.

Irving and Milton avenues, San Diego, Cal., will be extended and Logan avenue straightened.

The proposed paving of Cleveland Place, Denver, Colo., will cost $17,470, and of Court Place, $29,000.

J street, Sacramento, Cal., is to be repaved. Asphalt, basalt and granite are being discussed.

Ten thousand dollars will be expended in macamadizing Grand Park avenue, Mamaroneck, N. Y.

The growth of Washington, D. C., during the past year has created a necessity for more street paving.

Julian and San Salvador streets, San Jose, Cal., are to be graded and furnished with stone sidewalks.

A new street is to be opened to extend from Howard street through the marsh, south of Elkton, Md.

Parts of Front, Gambier, Vine, Chestnut, Sugar, Main and High streets, Mt. Vernon, Ohio, are to be paved.

Greene avenue, from Bedford to Nostrand avenues, Brooklyn, N. Y., will be re-paved with asphalt.

Citizens of Oakland, Cal., are protesting against the proposed widening of Broadway and Fourteenth street.

S. M. Harrington has the contract for grading Main street, Lewiston, Idaho. The work will cost the city about $12,000.

A $30,000 country road will be constructed on the division line between Queens and Suffolk counties, New York.

It is estimated that the sum of $32,000 will be necessary to meet the municipal expenses of Fort Howard, Wis., this year.

C. Culver, of Boone, Ia., has the contract for the brick paving of Eighth and Story streets in the business portion of the city.

The report of the city engineer of St. Paul, Minn., shows $94,523 expended for paving, and $24,187 for curbs and gutters during the last year.

An ordinance has been adopted by the city council of Erie, Pa., for the paving of Fourth street, from State to French, with brick.

An effort is being made to have the old Bergen road, between Cator and Greenville avenues, Greenville, N. J., graded and paved.

Parts of Second, Harrison, Main, Brady, Third, Front and Ripley streets and several alleys, Davenport, Ia., are to be paved with brick.

Parts of Fourth, York, Columbia and Isabella streets and Washington avenue, Newport, Ky., will be paved with brick in the early spring.

The city council, of Easton, Pa., is considering ordinances for the paving of two streets with vitrified brick on a six-inch base of concrete.

Twenty-second street, from Monroe to Woodruff avenue, Toledo, O., will be paved. Curtis and Bancroft streets will probably be macadamized.

The contract for paving four squares on George and Market streets, York, Pa., has been awarded to Odenwalt and Huber at $2.97 per square yard.

Assessments have been made for macadamizing Timea street, from Fifteenth to Sixteenth, and Ninth street, from Fulton to Orleans, Keokuk, Ia.

The presentation to the city of Cleveland, Ohio, of the magnificent Gordon park, will call for the construction of many streets and boulevards.

West Sixteenth and Seventeenth streets, from Gaines to Main street, and Spring street from Fifteenth to Eighteenth street, Little Rock, Ark., will be improved.

Parts of Charles street, Dalton avenue and Morris place, Cincinnati, will be paved with brick. Shillito street, from Race to Elm, with be paved with asphalt.

The contract for the improvements around the public square at Wilkes Barre, Pa., has been awarded to Parker & Cullis. The work will not be begun until spring.

Hickory street, from Ninth to St. Louis avenue; Main street, from Twelfth to Nineteenth, and Sixth street from Main to Delaware, Kansas City, Mo., are to be paved.

Parts of Glen Parker avenue, Taylor street, Elm street and Hopkins avenue, Cincinnati, O., will be paved. A brick pavement will be laid on Oak avenue at a cost of $19,242.

Burlington, Ia., laid 50,000 yards of brick paving last year, and is planning for more during '93. The Granite Brick Company, of that city, is furnishing all its brick to the home market.

Ordinances have been passed providing for the paving of Twelfth street, between Frost avenue and Broadway, and Independence avenue, from Grand to Highland avenues, Kansas City, Mo.

Second street, between Market and Green; Green street, between Main and Second, and Church street, between Myrtle avenue and the Richmond road, Ottumwa, Ia., will be paved and curbed.

Bids have been opened for the paving of parts of Dorr street, Western avenue, Wisconsin street and Nebraska avenue, Toledo, O. A protest is being made against the proposed paving of Curtis street.

About four and one-quarter miles of paving, almost all of which is to be cedar blocks, will be laid next season in Minneapolis. The most extensive work will be done on Franklin, Washington and Eighth avenues.

A movement is being made in Nebraska City, Neb., for the paving of First avenue this year. Public improvements in Nebraska City during 1892 were confined almost exclusively to street paving. Nearly $75,000 were expended in this work. The material used is mostly brick.

Street paving in Dayton, Ohio, will be resumed with vigor in the spring. Plans and specifications for the construction of over ten miles of work have already been ordered. Among the streets that are to be paved are St. Clair, Kenton, East Fourth, West Fourth, West Third, Bridge, Brown, Wilkinson and Perry.

There will be expended for street improvements in Boston the sum of $1,280,000. Of this Commonwealth avenue will get $200,000; Columbia avenue, $100,000; India Square, $100,000; Harrison avenue, $225,000; Orchard Park, $60,000, and the Street Paving Department, $100,000.

Street improvements in San Francisco, Cal., will include the extension of Potrero avenue and Post street, the curbing with granite and the paving with basalt blocks or bituminous rock, of parts of Broadway, Pierce, Bluxome, Stevenson and Oak streets. A movement is being made for the repaving of Van Ness avenue.

The Boston board of street commissioners have submitted a report relating to a recent visit made by them to the cities of New York, Brooklyn, Chicago, St. Louis, Cincinnati, Atlanta and Kansas City, for the purpose of examining into the methods adopted by those municipalities in laying out and constructing streets and paying for the same.

Ten blocks of Edgecombe avenue; Westchester avenue, from Prospect to the Southern Boulevard; Twelfth avenue, from One Hundred and Twenty-ninth to One Hundred and Thirtieth street; Fifty-eighth street, from Eleventh avenue to the Hudson river, New York City, will be paved. Boscobel avenue will be opened as an approach to the Washington bridge.

Portland, Oregon, is tired of macadam streets. The subject is being discussed in such a manner as will probably lead to the paving of all the principal streets of the city. A contract has been made for the paving of seven blocks of Morrison street with Trinidad asphalt. The contract has been let for $22,406 for the paving with bituminous rock of Burnside street from First to Washington.

A large amount of street work is contemplated in Peoria, Ill. The following streets will probably be paved with brick: Adams, from Hamilton to Spring; Fulton, from Jefferson to Water; Jefferson, from Wayne to Abington; Hamton, from Monroe to North; Crescent Avenue; First, from Spencer to Seventh; Second, from State to Spencer; Spring; Third and Fourth, from Franklin to Spencer.

The city clerk, of Creston, Ia., will receive proposals until January 23 for paving Adams street, from Walnut to Division, about 10,666 square yards; Pine street, from Mills to Adams, about 4,480 square yards, and Maple street from Mills to Adams about 3,200 square yards; the work to be completed as early as practicable in the spring. The pavement is to be of brick with four inches of sand underneath, five and one-quarter inches of sifted sand between the two courses, and an upper layer of one inch of fine, sharp sand.

SEWERAGE.

Deadwood, S. D., will have a sewer system.

Fort Scott, Kan., is to have a new $15,000 sewer.

A sewer system is being put in at Waxahatchie, Tex.

Texarkana, Ark., is improving its sewerage system.

A system of sewerage is in contemplation for Columbia, Tenn.

Grand Junction, Colo., is agitated over the question of sewerage.

In 1893 the city of Minneapolis expects to lay six miles of sewers.

A ten-inch pipe sewer will be laid on Muzzey street at Chicopee, Mass.

Batavia, N. Y., is considering the question of a complete system of sewerage.

Dickman Bros. are putting in sewer connections on N street at South Omaha, Neb.

Moulden, Fries & Barr, contractors, are constructing a large sewer at Tipton, Ind.

It has been voted by the citizens of Stamford, N. Y., to construct a sewer system.

The sewer system will be extended considerably next year at North Tonawanda, N. Y.

A sewer is wanted in Twelfth street, from Parade to the eastern city limits at Erie, Pa.

A committee is contemplating a general revision of the sewerage system of Washington, D. C.

The aldermen of Lynn, Mass., appropriated $20,000 for sewers in Boston, Tudor and Lewis streets.

The citizens of Reading, Pa., recommend for adoption a sewerage system that will cost about $375,000.

The city of Fremont, Neb., has voted $90,000 sewerage bonds this season for work now being done.

Richard Lowrie was awarded the contract for the construction of a sewer in Lloyd street, Chester, Pa.

The sewer extension work on College avenue, B and Mendocino streets at Santa Rosa, Cal., has been completed.

King & Kennedy have completed their big sewer contract in North Des Moines, Ia. The city's improvements in these underground waterways this year are greater than any year of previous history.

Twenty-two thousand feet of sewer pipe is being laid at Chautauqua, N. Y. The total cost will reach nearly $40,000.

Street improvements ordered and approved by the council of Chicago, Ill., include sewers in thirty-seven streets.

The committee on sewers of the city council of Worcester, Mass., voted to put sewers in Orient and Shattuck streets.

The new sewer system of Phœnix, Ariz., is completed. It can now boast of the best sewers and water-works on the coast.

The people of Kingston, N. Y., have decided to expend the sum of $20,000 on the construction of a complete sewer system.

Harrisburg, Pa., will construct twelve-inch terra cotta pipe sewers in Penn street, Sayford avenue and James avenue.

An order has been presented the board of aldermen of Newton, Mass., laying out common sewers on Chestnut and Hunter streets.

The sewerage question is the subject of considerable discussion at Niagara Falls, N. Y. The minimum estimate of the cost is $126,056.

Tyler, Tex., is to have a sewerage system at once. The system will cover twenty-eight blocks in the principal part of the city.

An extension of the sewerage system is in contemplation from Douglass avenue through Sixth street northward, at Bridgeport, Tenn.

A twenty, eighteen, fifteen and ten inch tile sewer will be built in Clinton street, Buffalo, N. Y., and a twelve inch tile sewer in Newton street.

South Milwaukee, Wis., will have a complete system of water-works and sewerage. Also an electric plant to furnish arc and incandescent lights.

Plans for a sewage system for the entire village have been prepared by DeWitt C. Smith, of Schenectady, N. Y. The estimated cost is $22,000.

Residents of the Twenty-eighth ward have signed a petition for sanitary sewers in six blocks adjoining Taylor and Delmar avenues at St. Louis, Mo.

William Sommer has been awarded the contract for a sewer on North Tenth street to North Grand avenue, and east to O'Donnell street, at Springfield, Ill.

Engineer Van Buren, of the department of city works, of Brooklyn, N. Y., is planning the construction of a sewer system east of Ninth avenue and south of Fifteenth street, and also south of Eastern Parkway, between Prospect Park and Ralph avenue.

The subject of a sewerage commission for the city of Salem and the towns of Beverly, Peabody and Danvers, all in Mass., is being talked of in those places.

Work will begin in early spring on the Third street sewer at Ft. Wayne, Ind. It will be approximately 5,400 feet in length, and its estimate cost will be $38,000.

Sewers will be constructed in Williams avenue, Mississippi avenue, Borthwick street and Kearney street at Portland, Ore. Bids have been opened for same.

Fredin and Wilson will build a sanitary sewer through block 23, Third division, at Duluth, Minn., at a bid of $3,636. The contract is to be completed June 1st, 1893.

The Court street sewer extensions at Pekin, Ill., have been completed. The improvement is permanent and the value of property along that street is largely increased.

Contractors Schneider & Bakorney have completed the Tenth avenue sewer at Cedar Rapids. It is six and a half feet in the clear, 730 feet long, built of brick and cost $6,000.

The outlay for sewers at St. Paul, Minn., during the past year represents a total cost of $234,644.22. Seven and a half miles were laid. During 1893 this will be increased by 24,460 feet.

The Broad street sewer at Chattanooga, Tenn., is declared quite a success. A 20-inch pipe leads to the river, where the wastage is deposited where a moving current carries it away.

Maps and plans have been made by F. K. Baxter, of Utica, N. Y., showing the estimated cost of sewers for Herkimer, N. Y., to be $35,000. The city has been discussing the sewerage question for several years.

The work of excavating for the big sewer of the Tenth ward at Ft. Wayne, Ind., was begun at the foot of Glasgow avenue. F. E. Cole is the contractor, and the cost of the sewer in round numbers is $81,000.

The laying of the Military avenue main sewer-pipe from Platte avenue east to the sewer outlet ditch at Fremont, Neb., has been completed. This line covers a distance of 7,100 feet or about one and one-third miles.

The state board of health has not reported favorably on the proposed system of sewers for Carthage, N. C., as planned by Engineer McComb. Mr. Bogart is engineer for the board and will require the commissioners to change their plans so that the sewage will be carried below the town, involving great additional expenditure, making the cost of the system at least $200,000.

An intercepting sewer will be built along the water front at the foot of Alice, Jackson, Madison and Oak streets, at Oakland, Cal. The improvement will cost between $2,000 and $3,000, the sewer being about 2,000 feet long.

A number of sanitary engineers are surveying the village streets of Westerly, R. I., in order to furnish a plat for a complete system of sewerage to cover the territory included within the limits of the school district.

Work has been commenced on the twenty-four inch sewer on East Davis street. This is the Northern conduit of the terra cotta system. The terra cotta system extends east only as far as East Sixteenth street.

An ordinance has been passed at Seattle, Washington, establishing a public sewer on Third street, beginning at a point thirty feet south of the south line of Columbia street, and connecting with the public sewer on Cherry street.

Tschirgi & Kringle are making slow progress with the Fourth district sewer along Sixteenth street at Rock Island, Ill. All along that street the sewer lies deep below the surface, and the work is rendered much more tedious on that account.

The board of sewer commissioners of the city of Pawtucket, R. I., are making preparations for this year's sewer work by advertising for bids to furnish 1,500,000 hard burned body bricks. Delivery of same is to begin on the 15th of this month.

The material growth of Plymouth, Ind., and the introduction of water-works has made the question of a proper and adequate system of sewerage the most important one the city will have to solve for several years. A trunk sewer has been planned at a cost of $7,750.

A state ditch sewer is to be constructed in Indianapolis, Ind. It will be 11,000 feet long, varying in size from five and a half to ten feet, and will cost $250,000. Preparations for extensive sewer work will be made during the winter and work commenced in the early spring.

James Hillery has contracted with private parties at Washington, Ohio, to build a vitrified pipe sewer from Paint creek to the Worthington block, which will cost $500. The work is now under headway, and will be pushed to completion at once.

An ordinance has been passed at Moline, Ill., for the construction of a sewer, beginning at the west line of Twenty-sixth street at the center of Sixth avenue, thence run west on Sixth avenue to the center of Twenty-third street, thence run north to Fifth avenue, to connect with the sewer on that street.

Sealed proposals will be received by the city clerk of Toledo, Ohio, until January 9, 1893, for the construction of a cylindrical brick sewer, two and one-half feet inside diameter and four inch shell, along the center line of Woodville street from the sewer in Nevada street to the center of Navarre avenue.

City Engineer Thomson is considering a petition requesting some changes in the proposed main extensions of the Lake Union sewer tunnel, at Seattle, Wash. The work in the tunnel proper is in satisfactory progress, and the aim will be to have the extensions completed ready for service when the tunnel proper is done.

At Kansas City, Mo., a public sewer will be constructed along the old bank of the Missouri river from a point east of Santa Fe street to a point near the state line and connecting with the sewer system of Kansas City, Kan. A $29,441.60 extension will also be made to the O. K. creek sewer. Charles Shestedt & Sons received the contract.

Sealed proposals have been advertised at Roanoke, Va., for the construction and completion of the following lines of sewers: Terra cotta sewer pipe, on Jefferson street south, between Campbell and Tazewel avenues, section nine; and between Campbell and Luck avenues and between Henry and Commerce streets in section ten.

The Citizens' Improvement Club of Woodlawn Park, Chicago, are discussing the advisability of asking the city council to pass an ordinance whereby the sewerage system of Woodlawn will hereafter be maintained by the city, and that the property-owners be no longer compelled to undergo an assessment for its maintenance.

Preparations are being made for extensive sewer construction in Chicago next year. Bids for nearly $2,000,000 worth of sewers have been opened. The contemplated improvements are fifty-three in number. Among these improvements is the largest sewer in the city which is nine feet in diameter and seven and a half miles long.

The city board of equalization of Salt Lake City, Utah, instructed the city attorney to draw an ordinance authorizing the assessor and collector to levy the tax for the extension of the sewer system on the property along the east side of Second West street, between First and Second South; the west side of First West street, between First and Second South streets, and on the north side of Second South, between First and Second West.

The people living in the south-west part of the city of Racine, Wis, in the vicinity of Blue river, are circulating a petition to be presented to the council to have a main sewer built this coming summer. During the past season four and a half miles have been completed at a cost of $25,000 and turned over to the city. The members of the board have carefully inspected the work and pronounced it a first-class job in every respect.

WATER-WORKS.

Fergus Falls, Minn., will own its water-works.

The water-works system at Boyd, Wis., cost $6,000.

Kenosha, Wis., will expend about $175,000 for water-works.

Fitchburg, Mass., has appropriated $11,000 for water-works.

Fremont, Neb., has recently spent $29,000 for water-works extensions.

The new water-works standpipe at Dublin, Tex., will soon be completed.

Bids for building water-works at Pittsford, Vt., are wanted until Jan. 10.

Two thousand dollars have been used in extending the water-works at Albion, Nev.

A $4,000 water-works system will be built at the county insane asylum, Racine, Wis.

The contract has been let for a system of water-works in Niobrara, Neb., of $3,600.

The new water-works at Owosso, Mich., will be completed about the middle of this month.

Cannelton, Ind., is to have a new water-works plant, the cost of which will be $50,000.

The Stratford Supply Company offer to sell out to the city of Stratford, Ill., for $100,000.

A new department of public works, the water bureau, is to be established at Chicago.

Fourteen thousand dollars' worth of bonds have been voted for water-works in Kendrick, Idaho.

Twenty-four new filters have been placed in the reservoirs of the Chattanooga, Tenn., city water company.

The Port Huron (Mich.) water board has decided to purchase a 2,000,000 gallon pump at a cost of $41,000.

The Northern Water Storage Company has been incorporated at Denver, Col., with a capital stock of $50,000.

The work of laying new water mains on West Elm street at Peoria, Ill., is being pushed as rapidly as possible.

The laying of the water mains through the different streets of the town of Steelton, Pa., is being pushed rapidly.

Winchester, Mass., has petitioned the legislature for power to issue $100,000 in bonds for water-works extensions.

The Cornell dam, to be built in the Croton river, to increase the water supply of New York city will cost $4,000,000.

The city council of Dubuque, Ia., has decided to buy the plant of the Dubuque water company six months hence.

A $2,500,000 4% fifty year loan for the extension and perfection of the water supply of Boston is under consideration.

The aldermen of Lowell, Mass., have voted for a loan of $100,000 for a driven well system to afford an auxiliary water supply.

The council of Danville, Ky., has authorized John McLeod to prepare plans and estimate for the construction of a system of water-works.

Kearney and Arlington, N. J., are looking for water. It is proposed to sink a series of artesian wells and pump the water into a standpipe.

The city of Rome, Ga., will construct a new $500,000 water-works system. Two reservoirs of 2,000,000 and 3,000,000 gallons capacity, respectively, will be built.

The city of Spokane, Wash., has borrowed $500,000 for the purpose of securing a good water system. It has been decided to spend $312,000 in the laying of pipes.

The citizens of Buchanan, Mich., are agitating the question of erecting a dam in the St. Joseph river to obtain water for a water-works system and electric light plant.

A committee appointed by the Lebanon, Ind., council is making an inspection tour, visiting the water-works of various cities, with a view of estimating the cost of a plant in Lebanon.

When the present improvements are completed, Chadron, Neb., will have a water-works system costing nearly $75,000. A reservoir holding 1,000,000 gallons stands 192 feet above the level of the city.

The water-works question is being agitated at Waukegon, Ill.; Tipton, Ind.; Barnesville, Ga.; Edgefield, S. C.; De Kalb, Ill.; Winthrop, Mass.; Ipswich, Mass.; Winnipeg, Man.; Girard, O.; Ashland, O.; Perrysville, O.; Reading, O.; Cleveland, Tenn.; Celina, O.; Wenatchee, Wash.; McSherrystown, Pa.; Globeville, Colo.; Roodhouse, Ill., and Cameron, Texas.

The long-delayed work on the new intake tunnel at Milwaukee, Wis., has been resumed. The tunnel will cost $160,000. When completed it will have a capacity of 80,000,000 gallons a day. It will not be ready for use before next fall.

Barnesville, Ga., El Paso, Tex., Pittsford, Vt., Meridith, N. H., Waycross, Ga., Albuquerque, N. M., Rockford, Wash., Freemont, Colo., Buchanan, Mich., Ithaca, Mich., Blanchardville, Ill., Groesbeck, Tex., are to have water-works.

Improvements and extensions will be made in the water-works systems of Cottonwood, Idaho, and Newburg, N. Y., Taylor, Tex., Freemont, Neb., Norwood, O , San Diego, Cal., Montgomery, Ala., Lexington, Ky., Chautauqua, N. Y., East Aurora, N. Y., Oskaloosa, Ia., Sioux City, Ia., Santa Fe, N. M., Atlanta, Ill., Port Huron, Mich., Beatrice, Neb., Williamsburg, Tex., and Schuyler, Neb.

Chicago is at last free of its troubles over the water question. At a cost of five years' labor and more than $1,500,000 the four mile tunnel has been completed and is now in use. The pumps now in use have a capacity of 40,000,000 gallons of water every twenty-four hours. When the demand for it arises 130,000,000 gallons can be pumped up every day through this tunnel. The water is perfectly clear and entirely satisfactory.

BRIDGES.

The iron bridge east of Auburn, Ind., is completed.

The Middlefork bridge is completed at Rossville, Ind.

A new bridge is being built over Rock creek at Richland, Kan.

B. Langtry & Sons have finished a bridge at Melvern, Kan.

A new bridge is being built on West Main street at Trinidad, Colo.

A new $50,000 iron bridge is being built on Gay street, Knoxville, Tenn.

A new bridge has been constructed over Falling Run at New Albany, Ind.

The O. & M. Company is putting in a new steel bridge near Medora, Ind.

A new bridge is wanted to span the Colorado river at Wharton, Texas.

Messrs. Hanson and Smith are building a bridge in the town of Norman, Ill.

A new bridge is contemplated on West Seventh street, in New Albany, Ind.

The work on the steel bridge at Leavenworth, Kan., is under way. A dyke and two abutments are to be built this winter.

Aurora, Ill., expects to have a viaduct built over the Q tracks at Lincoln avenue.

A bridge is badly needed between the Second and Fifth wards at Houston, Texas.

Montgomery creek is spanned by a new iron bridge northwest of Knightstown, Ind.

A new iron bridge is being put across Fountain creek at Campbell's station, Tenn.

A much needed bridge has been erected on the North street road, one mile west of Horton, Kan.

The bridge over Temescal creek on Shattuck avenue at Temescal, Cal., is undergoing repairs.

The Detroit Bridge Company are building a bridge at Prophetstown, Ill., in consideration of $25,979.

A substantial iron bridge is now being constructed over Cherry creek, one mile south of Hallowel, Kan.

The town council of Bessimer, Colo., is arranging its finances to build a viaduct across the railroad tracks.

Work has been commenced on the Jacksonville and Southeastern bridge across the Illinois river at Havana, Ill.

Merrill, Wis., is to have a new wagon bridge across the Wisconsin river between the West Side and the Sixth ward.

Work is progressing rapidly on the bridge at the foot of Clinton street across Black river to West LaCrosse, Wis.

The question of bridging the Brazos river in Parker county, Texas, has been revived by the county commissioners.

D. H. Young was awarded the contract for building a new bridge over Cedar river at Chartes City, Ia., in consideration of $10,849.

The Rea bridge across the Sangamon river west of Cerro Gorda, Ill., has been completed and accepted by the board of supervisors.

The county commissioners of Cowley Connty, Kan., will construct a new bridge across Walnut river in Creswell township, that county.

J. L. Bayley was awarded the contract for constructing a bridge over Hangman creek on the Medical Lake road from Spokane, Wash.

Two new bridges will be built at Weatherford, Tex; one across Butcher branch, between Oak and Columbia streets and one on Walnut street.

The bridge being constructed at Montezuma, Ind., is beginning to take on a bridge-like appearance. The first span on the east side is completed.

The Fifth street bridge at Atchison, Kan., is to be repaired and a new bridge will span White Clay creek on Santa Fe street near St. Louis college.

The Victoria bridge over the St. Lawrence at Montreal is two miles long, cost over $5,000,000, and contains 10,500 tons of iron and 3,000,000 cubic feet of masonry.

The Llano bridge, at Llano, Texas, which has been in course of construction for some time past, is completed. It is 800 feet long, four spans, crossing the Llano river and cost about $40,000.

The St. Louis and Madison Bridge and Transfer Company, with a capital stock of $350,000, will be organized under the Illinois law to build a wagon way and electric street car line over the merchants' bridge in North St. Louis.

STREET LIGHTING.

Yoakum, Tex., will be lighted by electricity.

Anderson, Ind., is to have a $35,000 electric plant.

Nuda, N. Y., is to be illuminated with electricity.

Electric street lights are soon to be used in Holly, Mich.

A $10,450 electric plant will be erected in Fayette, Mo.

Brownwood, Tex., will soon be lighted with electricity.

Franklinville, N. Y., will probably be lighted by electricity.

Schuyler, Neb., will spend $7,500 in additional electric lights.

An electric light plant is to be established at Hillsdale, Mich.

Arrangements are being made for electric lights at Knowlton, Que.

Lexington, Neb., has voted to bond the city for the purpose of putting in electric lights.

The citizens of Madison, Neb., have voted to issue bonds for $3,500 for an electric light plant.

PUBLIC PARKS.

Orange, Cal., has two parks under way.

A public park is talked of in Rockford, Ill.

Anaheim, Cal., is arranging to construct a park.

Shawnee Park, Louisville, Ky., will be improved.

Ogden, Utah, will issue bonds to the extent of $50,000 to build public parks.

The city council of Moscow, Idaho, has taken steps to beautify the city park.

The capitol grounds at Austin, Tex., will be improved by an artificial lake, bronze statues, etc.

A tract of land southeast of Ogden, Utah, will probably be purchased by that city for a park.

A new park covering two blocks is under contemplation by the North Side Improvement Association, Sioux City, Ia.

An irregular piece of ground containing about three acres has been leased by the city of Redlands, Cal., for park purposes.

Work is progressing on the new Sportsman's park at St. Louis, Mo. It is proposed to make the bicycle track there one of the best in the country.

The park commissioners of Council Bluffs, Ia., have on hand $6,000 in ready money and propose to spend it by adding another to an already fine system of parks.

Mayor Washburne, of Chicago, suggests that the Lake Front park should be improved, and that the water front should be ornamented by an esplanade and harbor.

By the will of the late W. J. Gordon, Cleveland, Ohio, has recently become the recipient of a large park. A boulevard is proposed to connect this park with Wade Park.

The improvements of the public park of Oshkosh, Wis., have been stopped for the season. Fully $20,000 more will be expended before the improvements are completed.

STREET RAILWAYS.

Cleveland, O., has electric heaters in street cars.

The subject of an electric railway in Kendallville, Ind., is being discussed.

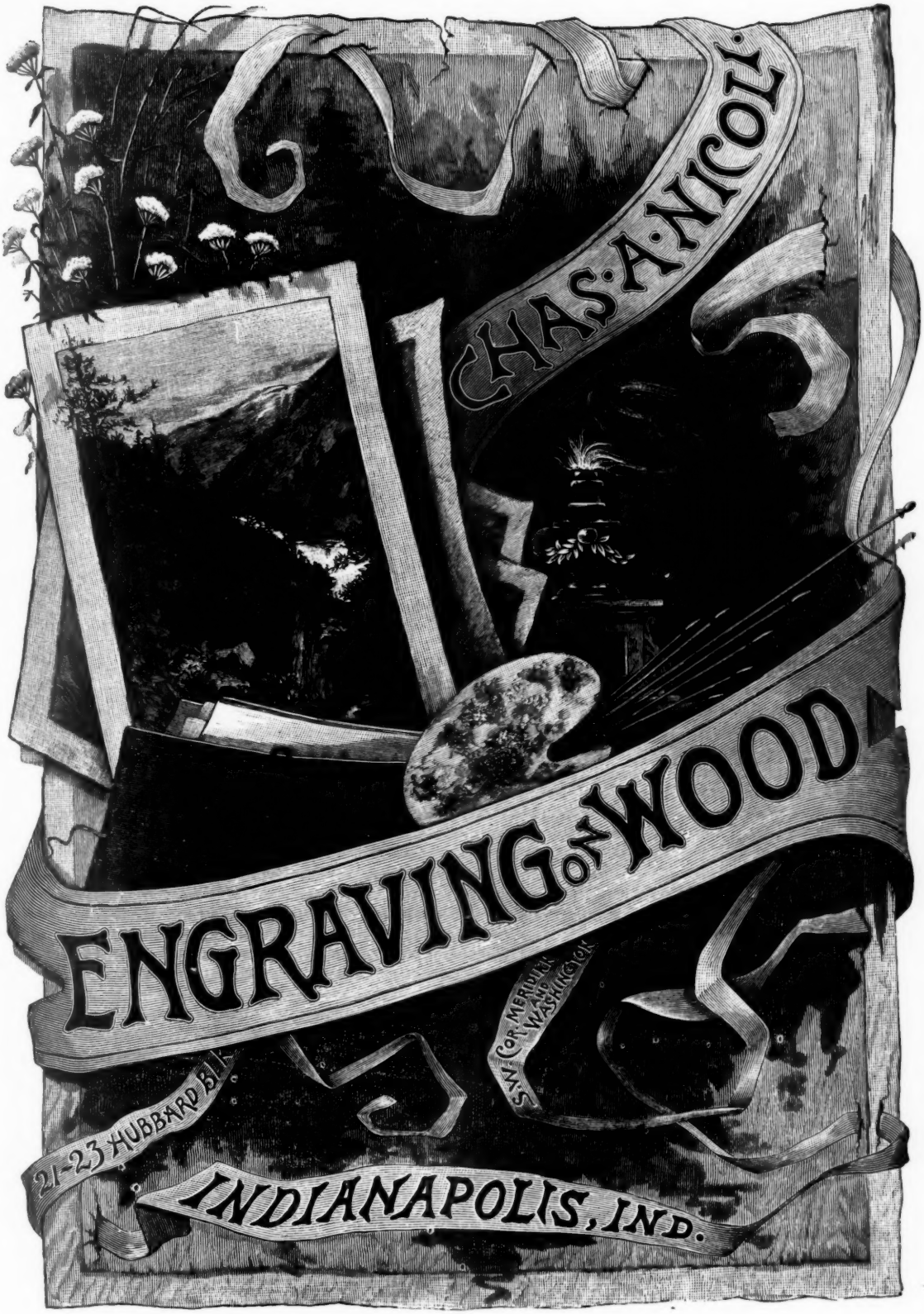
Toronto, Ont., will have its street cars operated entirely by electricity in the near future.

An elevated belt line for the joint use of the several electric railways in operation in the suburbs of Chicago, is proposed.

The Worcester and Milbury Street Railway Company, Worcester, Mass., propose an extension of their line to Southbridge and Charlton.

A New York syndicate has bought the street railway system of New Orleans for $10,000,000 and will change the motive power from mules to electricity.

The Citizens' Street Railway Company of Detroit will contract for the construction of fifty accelerator cars for its several lines, to be operated by electricity.


CHAS. A. NICOL.
ENGRAVING ON WOOD
S. W. COR. MERIDIAN & WASHINGTON
21-23 HUBBARD BLK.
INDIANAPOLIS, IND.

HIGH GRADE WORK AND LOW PRICES.

CUTS MADE OF BUILDINGS, MACHINERY AND CARDS.

H. C. BAUER,
DESIGNER AND WOOD ENGRAVER.
5&6 Bank of Commerce Building
INDIANAPOLIS, IND.

WOOD ENGRAVING AND ALL KINDS OF PROCESS WORK.

ESTIMATES CHEERFULLY FURNISHED.

CHAS. A. NICOLL
ENGRAVER ON WOOD
S. W. COR. WASHINGTON AND MERIDIAN STS.
INDIANAPOLIS, IND.

V. H. LOCKWOOD,

Patents

SOLICITOR AND COUNSEL,

(Successor to CHAS. P. JACOBS)

NO. 60 EAST MARKET STREET,

INDIANAPOLIS.

BRICK PAVEMENTS

BY

C. P. CHASE, Civil Engineer, Clinton, Iowa.

Full instructions from the beginning, with complete specifications.
The most useful and reliable hand book to be obtained. Price, One Dollar.

PATENTS

HOPKINS & ATKINS
Washington, D. C. 20 years' experience. Write for information.

RIPANS TABULES

RIPANS TABULES regulate the stomach, liver and bowels, and purify the blood; are safe and effectual; the best medicine known for indigestion, biliousness, headache, constipation, dyspepsia, chronic liver troubles, dysentery, bad complexion, dizziness, offensive breath and all disorders of the stomach, liver and bowels. One tabule gives immediate relief. Take one at meal time. Sold by Druggists. A trial bottle sent by mail on receipt of 15 cents.
RIPANS CHEMICAL CO., 10 Spruce St., New York.

SCHILLINGER BROTHERS,

CONTRACTORS FOR . . .

ASPHALT

PAVEMENTS

192-94 NORTH MORGAN ST.

Chicago.

Eastern Offices at Cincinnati, Cleveland, Detroit and Toledo, Ohio,

JUST PUBLISHED.

BRICK FOR STREET PAVEMENTS

An account of tests made of Bricks and Paving Blocks, with a brief discussion of Street Pavements and the method of constructing them.

BY

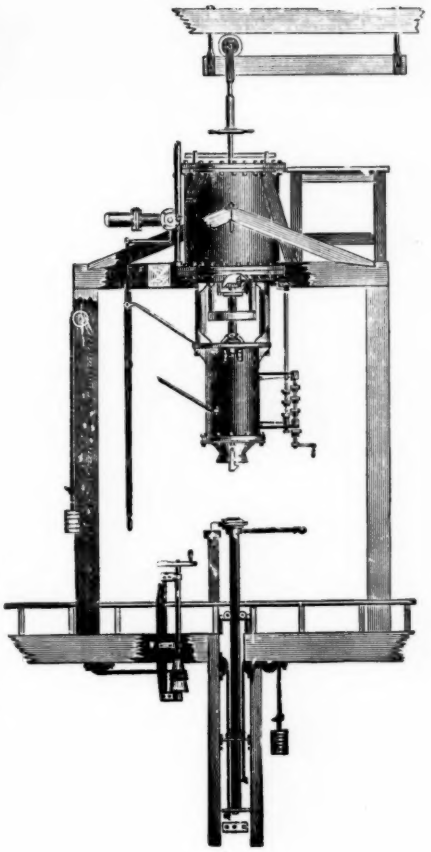
M. D. BURKE, C. E.

8vo. Paper. PRICE, FIFTY CENTS. Sent by Mail, Prepaid, on Receipt of the Price.

PAVING AND MUNICIPAL ENGINEERING,

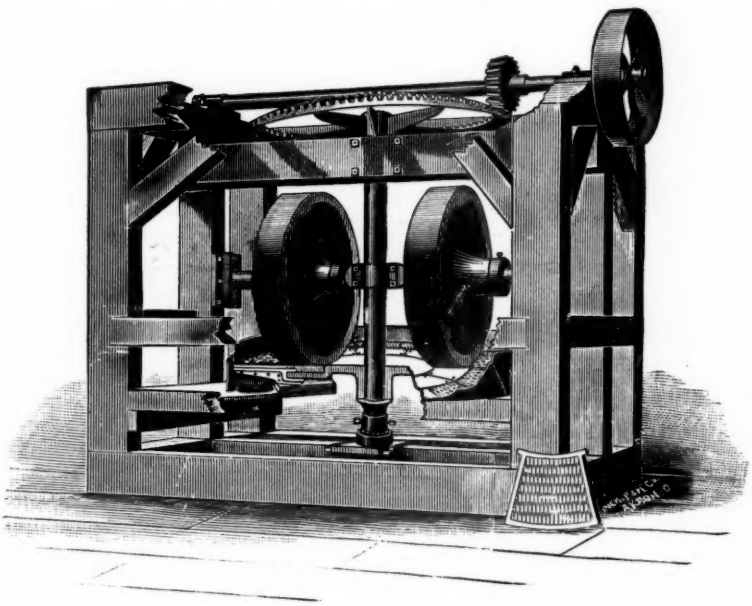
INDIANAPOLIS.

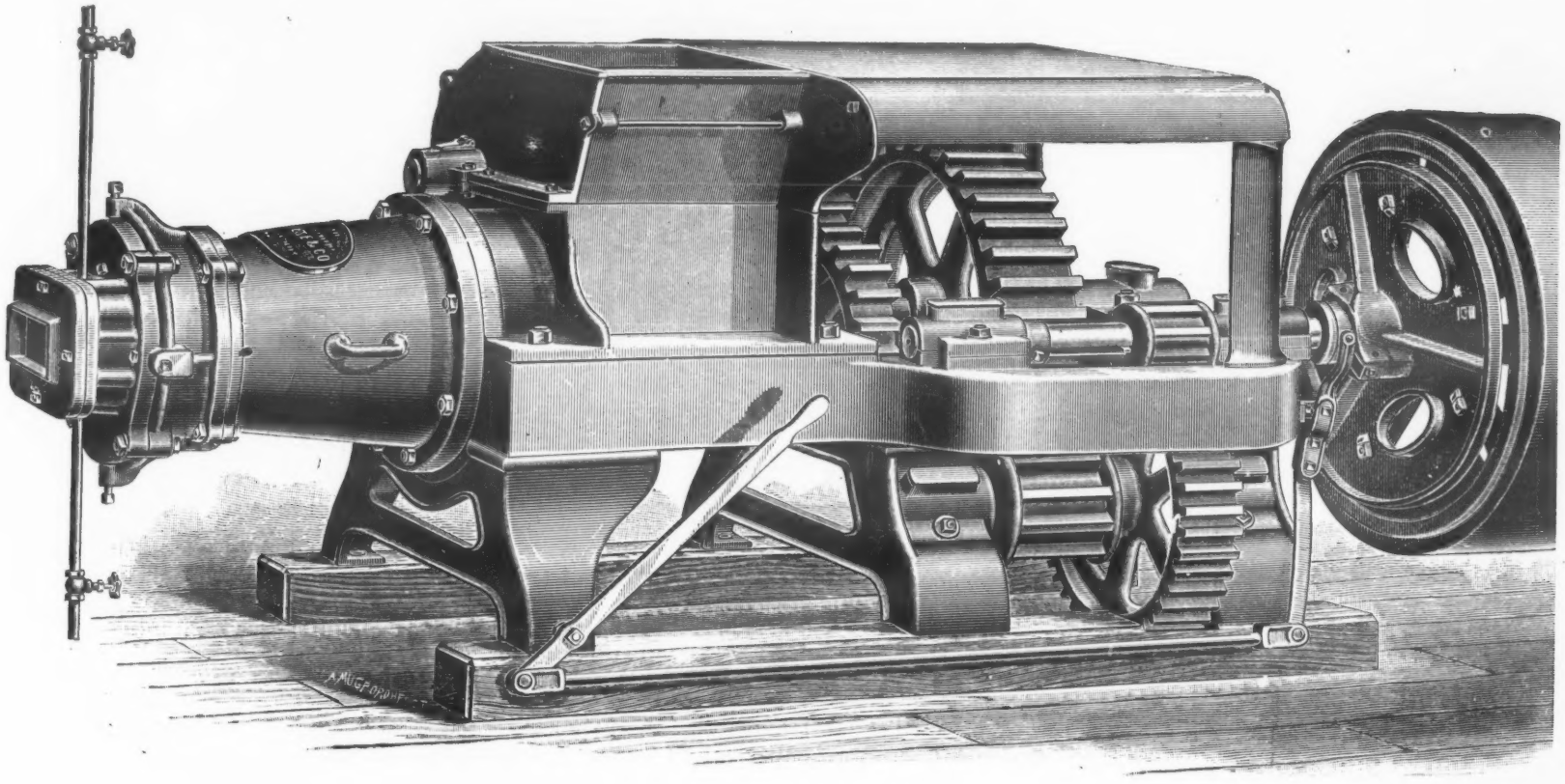
TAPLIN, RICE AND COMPANY



MANUFACTURERS OF IMPROVED
CLAY-WORKING MACHINERY OF
ALL KINDS, SUCH AS CLAY MILLS,
DRY AND WET PANS,
THE BARBER STEAM SEWER
PIPE PRESS, DIES, CLAY BLOCKERS,
POTTERS' WHEELS AND MACHINERY
OF EVERY DESCRIPTION.
WRITE FOR CATALOGUE AND PRICES.
PROMPT ATTENTION AND DISPATCH
GIVEN TO ORDERS.

PLEASE MENTION THIS PAPER



AKRON
OHIO

THE NEW "OHIO" BRICK MACHINE